Yolo Bypass Fish Monitoring Program: Ichthyoplankton Metadata

Dataset Title

Interagency Ecological Program: Ichthyoplankton catch and water quality data from the Sacramento River floodplain and tidal slough, collected by the Yolo Bypass Fish Monitoring Program, 1998-2022.

Short name or nickname you use to refer to this dataset:

IEP-YBFMP-Ichthyoplankton

Abstract

Largely supported by the Interagency Ecological Program (IEP), California Department of Water Resources (DWR) has operated a fish monitoring program in the Yolo Bypass, a seasonal floodplain and tidal slough, since 1998.

The objectives of the Yolo Bypass Fish Monitoring Program (YBFMP) are to:

1. Collect baseline data on water quality, chlorophyll, lower trophic level biota, and fish in the Yolo Bypass to monitor spatial and temporal changes in trends and abundance.

2. Analyze and communicate Yolo Bypass data with interested parties and the scientific and management communities to address pertinent management-related questions.

3. Provide technical expertise on Yolo Bypass aquatic ecology and monitoring and sampling methods.

The collection of ichthyoplankton is one of multiple elements of the YBFMP. Currently, the YBFMP collects ichthyoplankton in the Yolo Bypass from January to July. Historically, ichthyoplankton were also sampled in the Sacramento River, but due to low catch, this was stopped in 2019. Sampling is conducted with a 500-micron mesh conical plankton net. Fish are identified and enumerated by contractors (currently EcoAnalysts, Inc). The initial goal of ichthyoplankton monitoring was to compare the seasonal variations in densities and species trends within the Sacramento River channel and the Yolo Bypass, the river's seasonal floodplain (Sommer et al. 2003). The collection of ichthyoplankton samples is an important element in determining the annual presence, timing, and recruitment success of fishes utilizing the Yolo Bypass. Data on ichthyoplankton and associated water quality parameters are presented in this dataset.

Key findings to date include: (1) 26 species of fish larvae were observed in the Yolo Bypass during the 20-years of monitoring (Mollie Ogaz and J. Frantzich, DWR, unpublished data), including Delta Smelt, *Hypomesus transpacificus* (Sommer et al 2004); (2) The native Prickly Sculpin and non-native Threadfin Shad dominated samples, contributing to over 60% of the total larval catch (Mollie Ogaz and J. Frantzich, DWR, unpublished data); (3) Native species made up a higher percent of total catch in the Yolo Bypass (22.43%) in comparison to in the Sacramento River (10.2%), and appeared earlier in the year than many non-natives (Mollie Ogaz and J. Frantzich, DWR, unpublished data); (4) Similar to other seasonal floodplains in the San Francisco Estuary, alien fishes made up a large portion of the assemblage of early life stages in the Yolo Bypass (Sommer et al 2004); (5) Water temperature and stage are the best explanatory

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environmental variables for larval fish abundance in the Yolo Bypass (p=0.001). Flow was not statistically significant (Mollie Ogaz and J. Frantzich, DWR, unpublished data); (6) Species richness and diversity are higher in the Yolo bypass in comparison to in the Sacramento River (Sommer et al. 2004).

Investigators

First Name	Middle Initial	Last Name	Organization	e-mail address	ORCID ID (optional)	Role in project
		Interagency Ecological Program (IEP)				Creator
Lisa		Vance	California Department of Water Resources	Lisa.Vance@water.ca.gov	0000-0007-6954-1103	Creator, Field crew, Data contact

Other personnel names and roles

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Lisa		Vance	California Department of Water Resources	Lisa.Vance@water.ca.gov	0000-0007-6954-1103	Field crew, Data contact
Nicole		Kwan	California Department of Water Resources	Nicole.Kwan@water.ca.gov	0000-0003-1178-7788	PI, Data contact
Naoaki		Ikemiyagi	California Department of Water Resources			Field crew
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Mackenzie		Miner	California Department	Mackenzie.Miner@water.ca.gov		Field crew

Commented [NK2]: I would remove Cat, Jesse, and myself here - this was your effort!

I know we contributed to the original metadata document but here I view it as relating more to the actual publication, if that makes sense?

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			of Water Resources			
Catarina		Pien	California Department of Water Resources		0000-0003-4427-6300	Creator, Associate
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Louise		Conrad	Delta Stewardship Council	Louise.Conrad@water.ca.gov		Associate
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License

Keywords

Yolo Bypass, San Francisco Estuary, Sacramento-San Joaquin Delta, **Yolo Bypass Fish Monitoring Program**, California Department of Water Resources, **Interagency Ecological Program**.
[LTER controlled vocabulary] aquatic ecosystems, freshwater, ecology, estuaries, rivers, floodplain, seasonality, long term, communities, food webs, surveys, weather, turbidity, pH, electrical conductivity, water temperature, water quality, plankton, larvae, fish.

Funding of this work:

Funding is provided by the State Water Project.

Permitting of this work:

PI First Name	PI Middle Initial	PI Last Name	Permitting Agency and Permit Type	Permit Number	Brief Description
Nicole	M.A.	Kwan	CDFW Scientific Collecting Permit, Specific Use (SCP)	S-182970002-19100-001-01	The SCP covers all sampling activities and take of non-listed species.
Kelsey		Kelley/IEP	NMFS Scientific Research Permit	1440-3R	The National Marine Fisheries Service (NMFS) requires that the YBFMP have an Endangered Species Act (ESA) permit for the take of federally listed salmonids (winter and spring run Chinook Salmon and Central Valley Steelhead) and Green Sturgeon. This permit is coordinated through the Interagency Ecological Program (IEP).
Kelsey		Kelley/IEP	USFWS Delta Smelt Take		The US Fish and Wildlife Service (FWS) requires that the YBFMP have an ESA permit for the take of federally listed Delta Smelt. The FWS ESA permit for YBFMP is coordinated through IEP.
Kelsey		Kelley/IEP	NMFS Marine Mammal Protection Act		NMFS requires the YBFMP to have a MMPA permit to cover the potential

Commented [NK4]: Technically we have an additional interim CESA MOU for white sturgeon but I decided not to add it here since it didn't apply to the data collected during this time period. I will want to add it to the fish metadata pub though for your upcoming update

PI First Name	PI Middle Initial	PI Last Name	Permitting Agency and Permit Type	Permit Number	Brief Description
					take or harassment of marine mammals by our sampling activities. The sole usage of this permit for YBFMP is for the event that a sea lion gets trapped in our fyke trap. The MMPA permit for YBFMP is coordinated through IEP.
Nicole		Kwan	CDFW CESA MOU	2021-0006-R3_Kwan	DFW requires the YBFMP to have a CESA MOU to cover the take of state listed salmonids (winter and spring run Chinook Salmon) and osmerids (Delta and Longfin Smelt).

Timeframe

- Begin date: 1999-02-16
- End date: 2022-12-31
- Data collection: ongoing

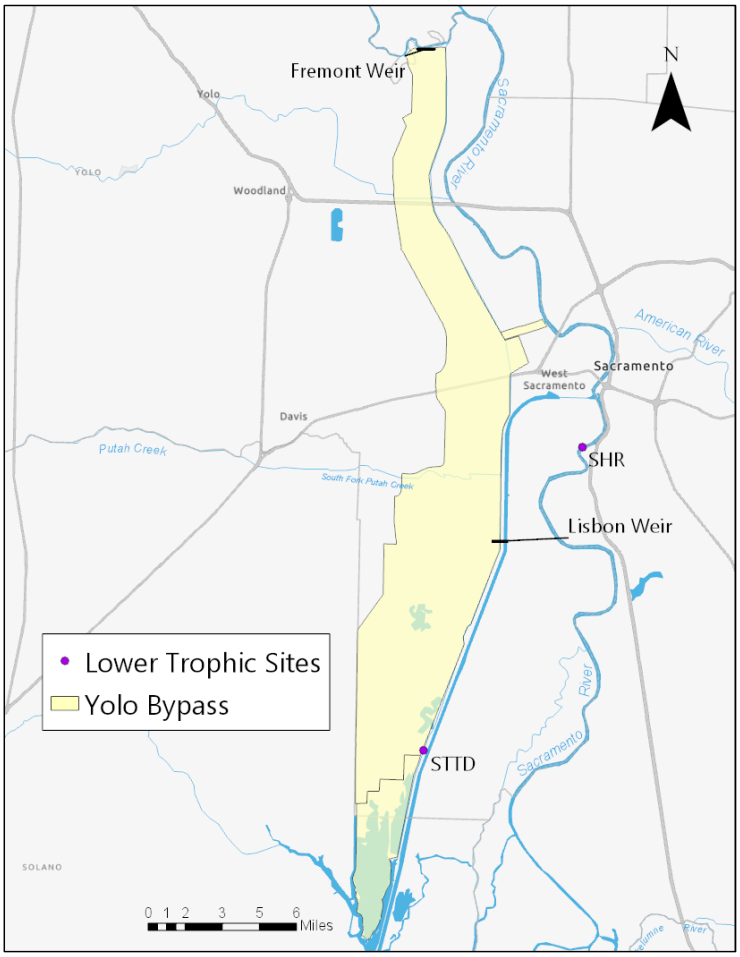
Geographic location

- Yolo Bypass tidal slough and seasonal floodplain and Sacramento River at Sherwood Harbor in West Sacramento, California, USA.
- North bounding coordinates (decimal degrees): 38.531881
- South bounding coordinates (decimal degrees): 38.353383
- East bounding coordinates (decimal degrees): -121.527912
- West bounding coordinates (decimal degrees): -121.643181

Station Name	Station Code	Latitude	Longitude

SHR (historical)	Sacramento River at Sherwood Harbor	38.53188	-121.528
STTD	Screw Trap in Toe Drain	38.35338	-121.643

Map of Sampling Sites



Taxonomic species or groups

[Family]: Salmonidae, Clupeidae, Osmeridae, Cyprinidae, Catostomidae, Ictaluridae, Poeciliidae, Atherinidae, Percichthyidae, Centrarchidae, Percidae, Gobiidae, Cottidae

Methods

I. Field Collection Methods

Water Quality

Water quality parameters are recorded at the start of each sampling event. Water temperature (degrees Celsius), electrical conductivity (microSiemens/cm), specific conductance (microSiemens/cm), pH, dissolved oxygen (mg/L), and turbidity (FNU) are sampled with a YSI ProDSS handheld meter. Turbidity values are averaged over three readings. Secchi depth is measured in the shade. Tide, condition of sampling (condition code), Microcystis level, vegetation rank, and weather are also recorded with water quality parameters.

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Ichthyoplankton Collection

A fixed net is used to collect ichthyoplankton samples from the Yolo Bypass at the base of the Toe Drain and the Sacramento River at Sherwood Harbor. Samples are collected on an ebb tide, either on a biweekly or weekly basis (during floodplain inundation). In the Yolo Bypass, samples are collected from January to the end of June from or adjacent to the YBFMP rotary screw trap, which is anchored in the middle of the Toe Drain channel. Sampling is no longer conducted in the Sacramento River due to low historical catch. See historical changes for more information. The net is fished just below the surface for 10 minutes, though sampling times may be shortened when high levels of debris interfere with sample collection. Tow times are recorded with each sampling event. Samples are washed down with deionized water and preserved in 5% Formalin with Rose Bengal dye to aid in separating organisms from detritus and algae.

Commented [NK6]: Ends up being 5% once diluted with the sample

Dimensions of the plankton net are as follows: 500-micron conical net, 2.5 m long with a 0.75 m diameter opening, equipped polyethylene cod-end jar screened with 500-micron mesh. General Oceanics flow meters (Model 2030R) are used to measure water volume.

II. Sample Processing and Tracking

Sample Tracking

Samples are tracked on an excel spreadsheet. A chain of custody (COC) listing sample number, date, time, location, type, and study/project is sent to contractors, who check that all samples are accounted for. Signatures are required of both the person responsible for sending the sample package, and the person receiving it. Once the sample is sent, the contractor is notified of approximate date of delivery.

Sample transfer

After being stored for a minimum of two weeks in 5% formalin, ichthyoplankton samples are rinsed through a 250-micron sieve. Large debris (leaves, sticks, etc.) are carefully rinsed and removed. The remaining sample is retained for identification and transferred to 70% ethanol. Samples are securely packaged to prevent leakage and breakage. Samples are then shipped to contractors for taxonomic identification. The contractors return the samples to DWR after completing analyses.

Contractor

EcoAnalysts, Inc.
1420 South Blaine Street, Suite 14

Mosco, Idaho 83843
208-882-2588
https://www.ecoanalysts.com/

Identification and Enumeration

The contractor filters samples through a 500-micron sieve. Samples are processed under a lighted, stereoscopic microscope with a minimum magnification of 5X. The ichthyoplankton (including their eggs) samples are enumerated and identified to the lowest taxonomic level possible (species preferred). The life stage for all enumerated ichthyoplankton samples is identified and recorded as either eggs, yolk-sac larvae, preflexion larvae, flexion larvae, post flexion larvae, or juveniles. All eggs are counted and identified to Family (species preferred). Up to 30 individuals of each ichthyoplankton species are measured in millimeters and recorded as both total length and fork length for each sample.

Sample Archive

Samples are stored by the contractor for up to 90 days, then returned to DWR for storage.

III. Quality Assurance and Control

Calibrations

YSIs are calibrated for pH, turbidity, dissolved oxygen (DO), and electrical conductivity (EC) following the DWR Quality Assurance Program guidance. Percent dissolved oxygen is also calibrated daily to local barometric pressure before use in the field. pH is checked two weeks after calibration to see if drift in readings is occurring. If drift has occurred, pH is recalibrated.

Sample Identification

Contractors re-identify 10% of samples to ensure 90% similarity.

Data Quality Control

Four levels of quality control are conducted on data:

1) Field data are checked by someone other than the data recorder prior to leaving each field site,
2) Datasheets are checked while being entered into the Microsoft Access/Excel database, which has customized error-checking and data validation checks,
3) A separate DWR staff member compares data from original field sheets to data entered into the database,
4) Prior to data publication, data are examined and visualized in R to look for outliers by station, year, and month. Values that are out of range are flagged, and select values are modified and/or re-calculated (see table below for more information). Water quality data are overlaid on real-time sonde data from Lisbon (data obtained from the California Data Exchange Center or CDEC) to ensure values are within range.

Notes on Data Quality

Flowmeter: There are known issues with the flowmeter data, and flowmeters generally. Flowmeter values are key to calculating CPUE, so QC efforts were conducted to try to account for some of these inaccuracies.

- Historically when flowmeters were not working, readings from another net's flowmeter were used instead. Because these nets have a different mesh and diameter, values from other nets cannot be reliably used. While samples which noted using values from other nets have been flagged, these comments may not have always been recorded.
- Before 2012, low-flow flowmeters were not consistently used under low flows, sampling at Sherwood Harbor often was done from shore even under low flows, and sampling was not always at a consistent tide. At flows that are too low, or during a switching tide, flowmeter values are not accurate. Samples noted to have had very low flows, or that were taken during a high tide, were flagged, but these comments may not have always been recorded.

Taxonomist changes: There have been changes in taxonomists throughout the years, which may influence the direct comparability of data from different contractors. Additionally, some samples were collected but sent to contractors much later, and thus samples may have been in poorer condition.

IV. Data Storage

Data Management and Archiving

Field data are collected and recorded on paper datasheets by DWR personnel, then entered into a Microsoft Access database. Currently the data is entered in Microsoft Excel. Paper datasheets are archived in binders that are stored at the West Sacramento DWR office, and electronic copies are archived on DWR/AEU Network drives.

Taxonomic results are received from the contractor via email in an Excel spreadsheet. Data are printed and entered into the Excel database by DWR personnel. Hard copies of the data are printed and stored in binders at the West Sacramento DWR office. Electronic copies of results for taxonomic analyses are archived on DWR/AEU Network drives.

V. Calculations and Analysis

Catch Per Unit Effort (CPUE)

The catch per unit effort (CPUE; count per cubic meter) taken in the ichthyoplankton net was calculated using the following equation:

$$\boldsymbol{CPUE} = \frac{C}{V}$$

C: the total number of a taxon counted for the sample
V: the volume of water sampled through the net (m3)

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.):

$$\boldsymbol{V} = \frac{(Flowmeter\ count\ end - Flowmeter\ count\ start) * R}{999999} * Net\ Mouth\ area$$

R: Rotor constant, specified in the General Oceanics Flowmeter 2030R manual. Depends upon which the flowmeter rotor was used during each sampling event, which is identified in the sampling database: Regular flow = 26873, Low flow = 57560

VI. Historical Changes

Equipment

- **Physical Water Quality:** Prior to 2011, YSI 63, and possibly others. Between 2011-October 2016, a YSI 556 was used. Starting October 2016, a YSI ProDSS was used.
- **Turbidity:** February 2012-October 2016: Glass vials of water were collected and analyzed with Hach 2100Q portable turbidimeter. Starting in late October 2016, the YSI ProDSS was used. Thus, units shift from NTU to FNU. Although these units are not exactly the same and cannot be standardized, they are very close to each other (Memo, DWR, 2020), so we have decided to keep all turbidity readings in one column for ease of analyzing data.

Methods

Field Sampling

- **1999 – 2010:** Ichthyoplankton sampling was typically conducted at least once monthly from March – June. During some years, sampling was started in January and/or conducted weekly during the inundation and drainage of the Yolo Bypass.
- **2002:** Conductivity starts being collected
- **May 2008:** Specific Conductivity, pH, Dissolved Oxygen start being collected
- **2011 – 2015:** Sampling was conducted at least biweekly (every other week) year-round and weekly during floodplain inundation and drainage events at STTD and SHR.
- **February 2012:** Turbidity starts being collected.
- **2012 – 2017:** During low flows (usually June-January) Sherwood samples are collected from a boat (rather than from shore) to ensure sufficient flow for adequate sample collection. At the Sacramento River (Sherwood) site, nets are deployed dockside during periods of higher flows (typically January-June), and from a boat at 2-3 mph when downstream flows are insufficient (e.g. <2 fps, typically July-December).
- **2016:** Sampling at SHR was reduced to January-June due to minimal or no catch between July-December.
- **2016 – 2017:** Sampling at STTD was reduced to January-July due to minimal or no catch between July-December.
- **Late October 2016 – present:** Turbidity readings taken by YSI instead of Hach turbidimeter.
- **2017 – present**: Sampling was suspended at SHR due to lack of catch.
- **2018**: Samples were collected at STTD year round.
- **2019:** Sampling at STTD returned to January-June.
- **March 2020 – December 2020**: Sampling suspended due to COVID-19.
- **April 2021**: Sampling restarted, drift and ichthyoplankton flowmeter now separate
- **February 2022**- current: new samplealtered, flow direction variables from recommendations from Interagency Ecological Program Data Utilization Working Group, and stopped recording region

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Sampling Frequency by Month and Year

Yolo Bypass Screw Trap at Toe Drain (STTD)

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Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1999	0	0*	2*	6	7	2	0	0	0	0	0	0	**17**
2000	0	0*	2*	0	1	1	0	0	0	0	0	0	**4**
2001	1	1	2	2	1	1	0	0	0	0	0	0	**8**
2002	0*	0	2	2	5	3	0	0	0	0	0	0*	**12**
2003	0*	0	2	1	3*	2	0	0	0	0	0	0	**8**
2004	1*	2*	2*	2	1	1	0	0	0	0	0	0	**9**
2005	1	2	3	3	2*	2	0	0	0	0	0	0	**13**
2006	3*	2*	4*	2*	2	2	0	0	0	0	0	0	**15**
2007	0	0	2	1	2	0	0	0	0	0	0	0	**5**
2008	1	2	2	2	2	2	0	0	0	0	0	0	**11**
2009	2	2	2	2	2	2	0	0	0	0	0	0	**12**
2010	4*	2	3	2	1	1	0	0	0	0	0	0*	**13**
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	3	5	7	7	3	6	4	3	0	0	0	0	**38**
2016	1	2	2	4	0	0	1	0	0	0	0	0	**10**
2017	3*	4*	4*	8*	7*	3	3	0	0	0	0	0	**33**
2018	3	2	2	2	3	2	2	2	2	2	2	2	**26**
2019	2	3	3	4	2	2	2	0	0	0	0	0	**18**
2020	2	2	0	0	0	0	0	0	0	0	0	0	**4**
2021	0	0	0	1	2	2	0	0	0	0	0	0	**5**
2022	2	2	2	2	2	2	0	0	0	0	0	0	**12**
Total	**41**	**43**	**57**	**63**	**57**	**45**	**20**	**14**	**11**	**12**	**10**	**11**	**385**

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*Months with overtopping at Fremont Weir

Sacramento River at Sherwood Harbor (SHR)

Commented [NK11]: Got rid of 2017 onward since historical changes note that sampling ended

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1999	0	1*	1*	2	1	1	0	0	0	0	0	0	**6**
2000	0	0*	1*	0	0	0	0	0	0	0	0	0	**1**
2001	1	2	2	2	1	1	0	0	0	0	0	0	**9**
Year	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Total**
2002	0*	0	2	2	5	3	0	0	0	0	0	0*	**12**

2003	3*	0	1	2	3*	2	0	0	0	0	0	0	**11**
2004	1*	2*	2*	2	1	1	0	0	0	0	0	0	**9**
2005	1	2	3	3	2*	2	0	0	0	0	0	0	**13**
2006	1*	1*	2*	2*	2	2	0	0	0	0	0	0	**10**
2007	0	1	2	2	2	0	0	0	0	0	0	0	**7**
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	1	2	1	0	0	0	0	0	0*	**14**
2011	2*	2	2*	3*	2	3	2	2	2	2	3	2	**27**
2012	1	2	2	2	3	2	2	2	2	3	2	2*	**25**
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	3	4	6	5	4	4	3	2	0	0	0	0	**31**
2016	1	2	3	2	2	2	0	0	0	0	0	0	**12**
Total	**30**	**32**	**41**	**39**	**38**	**32**	**11**	**11**	**8**	**10**	**8**	**9**	**269**

Commented [LV12]: Removed summary table, will over expand with additional years. Consider re-organizing if needed

Commented [NK13]: I also deleted the notes column as they seemed more internal rather than useful to external data users.

Contractors/Taxonomists

Year	Ichthyoplankton
1999	uncertain
2000	uncertain, possibly CDFW
2001	uncertain, possibly CDFW
2002	uncertain, possibly CDFW
2003	uncertain, possibly CDFW
2004	J. Wang, possibly Tenera
2005	J. Wang, possibly Tenera
2006	J. Wang, possibly Tenera
2007	J. Wang, possibly Tenera
2008	J. Wang, possibly Tenera/EcoAnalysts
2009	J. Wang, Tenera?
2010	EcoAnalysts
2011	EcoAnalysts
2012	**EcoAnalysts**
2013	**EcoAnalysts**
2014	**EcoAnalysts**
2015	**EcoAnalysts**
2016	**EcoAnalysts**
2017	**EcoAnalysts**
2018	**EcoAnalysts**
2019	**EcoAnalysts**
2020	**EcoAnalysts**
2021	**EcoAnalysts**

2022	**EcoAnalysts**

Data Tables

Table Description: Ichthyoplankton catch and water quality from the Yolo Bypass Fish Monitoring Program

Column name	Description	Unit or code explanation or date format	Empty value code
Event_id	Unique event identifier	Station_datetime	
Datetime	Date and time of sample	yyyy-mm-dd_ hh:mm:ss	
Station	Sample Site	STTD = Screw Trap at Toe Drain, SHR = Sherwood Harbor	
WY	Water Year	Water Year	
WYClass	Water year type	W = wet D = dry A = average	NA
Inundation	Did overtopping occur	True = Yes False = No	NA
WeatherCode	Weather at time of water quality sample	CLR = Direct sunlight RAN = Precipitation CLD = Overcast/Cloud cover >50% FOG = Foggy NIT = Night	NA
Tide	Tidal stage	Ebb, Flood, High	NA
MicrocystisVisualRank	Visual rating of Microcystis in sampled body	1 = Microcystis absent 2 = Low-widely scattered colonies 3 = Medium-adjacent colonies 4 = High-contiguous colonies 5 = Very high-concentration of contiguous colonies forming mats and scum	NA
WaterTemperature	Temperature of water	celsius	NA
Secchi	Secchi depth sample collected	meters	NA
Conductivity	Electrical conductivity of water	microSeimenPerCentimeter	NA

SpCnd	Specific conductivity of water	microSeimenPerCentimeter	NA
pH	Total pH of water	dimensionless	NA
DO	Dissolved oxygen concentration	milligramsPerLiter	NA
Turbidity	Turbidity of water	FNU	NA
ConditionCode	Condition of gear during sample such as high debris	1 = Good/normal 2 = Fair (partial block, etc.) 3 = Poor (total block) 4 = No sample taken	NA
FieldComments	Field comments		NA
MeterSetTime	Amount of time ichthyoplankton net was set	minutes	NA
FlowMeterSpeed	Flowmeter speed (2 types of flowmeters)	Low = used for low flow, Regular = used for all other flows	NA
FlowMeterStart	Starting flowmeter value		NA
FlowmeterEnd	End flowmeter value		NA
Flowdiff	Original calculated flowmeter difference	FlowmeterEnd minus FlowmeterStart	NA
FlowdiffAdj	Replaced flowmeter difference values, accounting for QC as described above		NA
Volume	Total volume of water sampled in net	liters	
VolumeAdj	Edited volume sampled based on replaced flowdiff	liters	
LabComments	Comments from contractor		NA
SpeciesCode	In-house organism ID	Used to connect to taxonomic table	
CommonName	Common name of organism	Common name of organism identified	NA
ScientificName	Scientific name of organism	Scientific name of organism identified	NA
LifeStage	Life stage determined		NA
Count	Number of zooplankton enumerated		

CPUE	Catch per unit effort	Count/cubic meter	
CPUEAdj	Re-calculated CPUE, accounting for QC as described above	Count/cubic meter	
FlagPhys	Flag for Physical data QC		
CommentPhys	Comment for Physical data QC (described above)		NA
FlagSamp	Flag for sampling QC (described above)	0 = no comments/blank 1 = comments but deemed acceptable 2 = suspicious 3 = highly suspect	
CommentSamp	Comment for sampling QC		NA
FlagLab	Flag for laboratory QC2 (described above)	Flag for lab comments made by contractor 0 = no comments/blank 1 = comments but deemed acceptable 2 = suspicious 3 = highly suspect	
CommentLab	Comment for laboratory QC		NA
FlagFM	Flag for flowmeter QC		NA
CommentFM	Comment for flowmeter QC		NA
FlagCPUE	Flag for CPUE QC (described above)		NA
CommentCPUE	Comment for CPUE QC		NA
QCFlags	Summary of qc flags on data	Summary quick view of qc flags on data	NA
QCCOmments	Summary of qc comments on data	Summary quick view of qc comments on data	NA

Table description: Ichthyoplankton Taxonomic Tree

Column name	Description	Unit or code explanation or date format	Empty value code
Code	In-house organism ID	Used to connect to catch and water quality table	
IEP Fish Code	Standardized code for use across IEP programs		NA
Common Name	Common name of organism		NA
Scientific Name	Scientific name of the organism identified		NA

Table description: Ichthyoplankton sampling station locations

Column name	Description	Unit or code explanation or date format	Empty value code
StationCode	Sampling Station	STTD = Screw Trap at Toe Drain, SHR = Sherwood Harbor	
StationName	Station name		
Latitude	Latitude of sample location	Decimal degree	
Longitude	Longitude of sample location	Decimal degree	

Articles

Article DOI or URL (DOI is preferred)	Article title	Journal title
https://doi.org/10.47886/9781888569599.ch8	Ecological Patterns of Early Life Stages of Fishes in a Large River-Floodplain of the San Francisco Estuary	Early Life History of Fishes in the San Francisco Estuary and Watershed, AFS Symposia
https://www.noaa.gov/sites/default/files/legacy/document/2020/Oct/07354626776.pdf	Floodplain as Habitat for Native Fish: Lessons from California's Yolo Bypass	

Scripts/code (software)- Optional

File name	Description	Scripting language

Commented [NK14]: Is this like a works cited or supposed to be work published based on this data? If the former, we'll want to update with the literature referenced earlier in the doc - if the latter I'm not sure we have anything to add

Commented [NK15]: We should probably remove the empty tables right?

https://github.com/AEU-DISE/drift-ichthyo-publish	All code and files used for publication	
Ichthyo_QAQC.rmd	Script for cleaning and QC ichthyoplankton data	R
LTPhysicalData_QAQC.rmd	Script for cleaning physical data for lower trophic sampling	R

Data provenance

Dataset title	Dataset DOI or URL	Creator (name & email)	Contact (name & email)

Notes and Comments

Versioning History

Version number	Date created	Description of changes	Justification for change	Version editor	Contact info
1.0	1/14/2021	Finalized metadata using Yolo Bypass template	Standardized and elaborated on metadata documents for YBFMP internal review, based on template from EDI and IEP	Craig Stuart (content), Catarina Pien (standardization)	Catarina.Pien@water.ca.gov
1.1	5/17/2021	Changed instances of egg and larval, or similar, to ichthyoplankton	Decided as part of the internal review to standardize to ichthyoplankton	Catarina Pien	Catarina.Pien@water.ca.gov
1.2	10/26/2022	Updated staff and permits; some language changes	Staff and permit number changes; edited language for clarity	Nicole Kwan	Nicole.Kwan@water.ca.gov
1.3	12/5/2024	Updated tables, sampling alteration dates,	Update for publishing to EDI and CNRA open data portal	Lisa Vance	lisa.vance@water.ca.gov

Appendix

Field Data Sheet

LOWER TROPHIC SAMPLING – YOLO BYPASS STUDY upd. 2/8/2023

StationCode: | Recorder: | Field Check: | Crew: | YSI#:

Date: | Time: | WeatherCode: | Microcystis Rank (1-5): | Vegetation Rank (1-4):

Secchi: m | Water Temp: °C | DO: mg/L | SpCnd: µΩ | EC: uS/cm | pH:

YSI Turbidity: Take reading every 30 sec ① FNU ② FNU ③ FNU Mean YSI Turb: FNU

Tide: | Flow Dir: U N D | Comments:

Light Attenuation

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

	Depth:	Subsurface Irradiance (in **water** avg):	
① 0.75 = µmol	① m	µmol	75%
② 0.50 = µmol	② m	µmol	50%
③ 0.25 = µmol	③ m	µmol	25%
④ 0.01 = µmol	④ m	µmol	1%

Comments:

Drift Sample

Set Time: min | Flow Meter Speed: REG / LOW | Start Meter: | End Meter: | Revs: | Condition Code: | Sampling Altered: | Comments:

Ichthyoplankton Sample

Set Time: min | Flow Meter Speed: | Start Meter: | End Meter: | Revs: | Condition Code: | Sampling Altered: | Comments:

Zooplankton Sample

Flow Meter Speed: REG / LOW

150µm		50µm	
Condition Code:		Condition Code:	
Sampling Altered:		Sampling Altered:	
Comments:		Comments:	
150 Set Time: min		50 Set Time: min	
Start Meter:		Start Meter:	
End Meter:		End Meter:	
Revs:		Revs:	

	Yes	No	Replicate
Chlorophyll Sample :			
Phytoplankton Sample :			
Nutrient Sample :			

WDL SAM Code:

Filtered: _____mL @ 0.35 bar Time Filtered: _____

Comments:

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

Tide Codes

EBB Moving from high to low
FLD Moving from low to high
HIGH 30 mins before or after high
LOW 30 mins before or after low
OB Water at site is over the bank

Flow Direction

During overtopping,

U Upstream: North (to the right if facing toe drain)
D Downstream: South (to the left)
N Neutral: neither or can't tell

Condition Code

1 Good (normal sample)
2 Fair (sample partially compromised; less than 50% loss in effort or catch)
3 Poor (sample majorly compromised; 50%+ loss in effort or catch)
4 No sample taken 100% loss of effort/sample

Sampling Altered

Y Includes alteration of sampling location, time, methods, not necessarily related to quality.
N Normal sample

Vegetation Code

1 No veg present
2 Veg present but no impact to sample
3 Veg present and impact to sample
4 Veg present and prevented sample

Procedures in Brief

1. Assess the site for safety.
2. Record site and field crew information.
3. Collect **Water Quality** measurements.
4. Triple rinse water collection bottles (1L) and **collect water** for chlorophyll, nutrients and phytoplankton using Van Dorn..
    - Be sure to collect water quality and water samples closely together.
5. Put water samples directly on ice.
6. Conduct Light Attenuation.
    - Procedure is located in the back of the pelican case.
7. Prepare nets for tows.
8. Conduct tows for **Ichthyoplankton** and **Drift Invertebrate** simultaneously. Ichthyoplankton should be on the **port** side of the trap/boat. Drift should be on the **starboard** side of the trap/boat.
    - Ichthyoplankton tow only collected at the Screw Trap site (STTD).
    - Tows typically 10 min, but may be shortened if conditions require (e.g., high turbidity or debris set times can be halved or more.
9. Conduct 150 and 50 um **zooplankton** tows simultaneously. Zoop-150 should be on the **starboard** side of the trap/boat. Zoop-50 should be on the **port** side of the trap/boat.
    - Tows conducted at both STTD and SHR.
    - The 150 um tow is for 5 min and 50 um for 2 min, unless conditions require shorted durations.
10. Transfer tow samples to the respectively labelled collection bottle. Use DI water to rinse specimens into the bottle and add 2 parts Formalin (use PPE).
11. Collect temperature data from HOBO logger (if able).
12. Upon returning to the lab, bring the datasheet with you while filtering water samples to record the water volume filtered (mL) and vacuum pressure used (bar).

Fish Species Codes

Code	Common Name	Scientific Name
AMS	American Shad	*Alosa sapidissima*
ASE	American Shad Eggs	*Alosa sapidissima*
AMM	Ammocoete Lamprey	*Petromyzontidae*
BPF	Bay Pipefish	*Syngnathus leptorhyncus*
BKB	Black Bullhead	*Ameiurus melas*
BKS	Black Crappie	*Pomoxis nigromaculatus*
BGS	Bluegill	*Lepomis macrochirus*
BKT	Brook Trout	*Salvelinus fontinalis*
BRB	Brown Bullhead	*Ameiurus nebulosus*
BT	Brown Trout	*Salmo trutta*
CAR	California Roach	*Lavinia symmetricus*
C	Carp	*Cyprinus carpio*
CHG	Chameleon Goby	*Tridentiger trigonocephalus*
CHC	Channel Catfish	*Ictalurus punctatus*
CHN	Chinook Salmon, Unknown Race	*Oncorhynchus tshawytscha*
CO	Clupeidae Eggs	
DSM	Delta Smelt	*Hypomesus transpacificus*
FHM	Fathead Minnow	*Pimephales promelas*
GF	Gold Fish	*Carassius auratus*
GSN	Golden Shiner	*Notemigonus crysoleucas*
GST	Green Sturgeon	*Acipenser medirostris*
GSF	Green Sunfish	*Lepomis cyanellus*
HH	Hardhead	*Mylopharodon conocephalus*
HCH	Hitch	*Lavinia exilicauda*
MSS	Inland Silverside	*Menidia beryllina*
JSM	Jacksmelt	*Atherinopsis californiensis*
LAM	Lamprey, Unidentified Adult	*Petromyzontidae*
LMB	Largemouth Bass	*Micropterus salmoides*
LP	Logperch	*Percina macrolepida*
LFS	Longfin Smelt	*Spirinchus thaleichthys*
MQF	Mosquito Fish	*Gambusia affinis*
NAN	Northern Anchovy	*Engraulis mordax*
BL	Pacific Brook Lamprey	*Lampetra pacifica*
PAH	Pacific Herring	*Clupea harengeus pallasii*
PL	Pacific Lamprey	*Lampetra tridentata*
PSS	Pacific Staghorn Sclupin	*Leptocottus armatus*

PE	Percichthyidae eggs	
PMP	Plainfin Midshipman	*Porichthys notatus*
PRS	Prickly Sculpin	*Cottus asper*
SF	Pumpkinseed	*Lepomis gibbosus*
RBT	Rainbow Trout (Steel Head)	*Oncorhynchus mykiss*
RBTT	Rainbow Trout, Tagged	*Oncorhynchus mykiss*
RSN	Red Shiner	*Cyprinella lutrensis*
RES	Redear Sunfish	*Lepomis microlophus*
REB	Redeye Bass	*Micropterus coosae*
RFS	Riffle Sculpin	*Cottus gulosus*
RL	River Lamprey	*Lampetra ayersi*
SCB	Sacramento Blackfish	*Orthodon microlepidotus*
SAPM	Sacramento Pikeminnow	*Ptychocheilus grandis*
SPLT	Sacramento Splittail	*Pogonichthys macrolepidotus*
SASU	Sacramento Sucker	*Catostomus occidentalis*
SHM	Shimofuri Goby	*Tridentiger bifasciatus*
SMB	Smallmouth Bass	*Micropterus dolomieu*
SPD	Speckled Dace	*Rhinichthys osculus*
STF	Starry Flounder	*Platichthys stellatus*
STB	Striped Bass	*Morone saxatilis*
SBE	Striped Bass Eggs	*Morone saxatilis*
Code	Common Name	*Scientific Name*
SSM	Surf Smelt	*Hypomesus pretiosus*
TFS	Threadfin Shad	*Dorosoma petenense*
TSE	Threadfin Shad Eggs	*Dorosoma petenense*
TSS	Threespine Stickleback	*Gasterosteus aculeatus*
TSM	Top Smelt	*Atherinops affinis*
TP	Tule Perch	*Hysterocarpus traski*
POM	Unid Crappie	*Pomoxis spp*
CAT	Unid Ictalurid (catfish or bullhead)	*Ictaluridae*
BAS	Unid Juvenile Bass	*Micropterus spp*
MIN	Unid Juvenile Minnow	*Cyprinidae*
SNF	Unid Juvenile non-Micropterus Sunfish	*Centrarchidae*
SCP	Unid Juvenile Sculpin	*Cottus spp.*
STG	Unid Juvenile Sturgeon	*Acipenser spp.*
LEP	Unid Sunfish	*Lepomis spp*
TRD	Unid Tridentiger	*Tridentiger spp.*
WAG	Wakasagi	*Hypomesus nipponensis*

W	Warmouth	*Lepomis gulosus*
WHC	White Catfish	*Ameiurus catus*
WHS	White Crappie	*Pomoxis annularis*
WCK	White Croaker	*Genyonemus lineatus*
WST	White Sturgeon	*Acipenser transmontanus*
YEB	Yellow Bullhead	*Ameiurus natalis*
YFG	Yellowfin Goby	*Acanthogobius flavimanus*