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

Abstract

The Yolo Bypass Fish Monitoring Program (YBFMP) operates a rotary screw trap and fyke trap and conducts biweekly beach seine and lower trophic surveys in addition to maintaining water quality instrumentation in the bypass. The YBFMP serves to fill information gaps regarding environmental conditions in the bypass that trigger migrations and enhanced survival and growth of native fishes, as well as provide data for IEP synthesis efforts. YBFMP staff also conduct analyses of YBFMP monitoring data to address pertinent management related questions as identified by IEP. The Yolo Bypass has been identified as a high restoration priority by the National Marine Fisheries Service and US Fish and Wildlife Service Biological Opinions for Delta Smelt, Winter and Spring-run Chinook salmon and by California EcoRestore. The YBFMP informs the restoration actions that are mandated or recommended in these plans and provides critical baseline data on the ecology of the bypass and how it interacts with the broader San Francisco Estuary. Only juvenile and adult fish catch with associated water quality are presented in this dataset. Our overall program objectives include:

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 stakeholders 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.

Specifically, the objectives of the water quality monitoring are to:

1. Examine spatial and temporal trends in water quality.
2. Examine the relationship between water quality and biological observations.

We sample physical water quality discretely when conducting biological monitoring using a YSI ProDSS. Nutrient and chlorophyll data are taken biweekly along with lower trophic tows. Water is sampled at three sites along the Yolo Bypass and Sacramento River, then processed and analyzed by an internal DWR laboratory.

Keywords

Yolo Bypass
San Francisco Estuary
Sacramento-San Joaquin Delta
Yolo Bypass Fish Monitoring Program
California Department of Water Resources
Interagency Ecological Program
tidal slough
water quality
nutrients
chlorophyll
cations
anions

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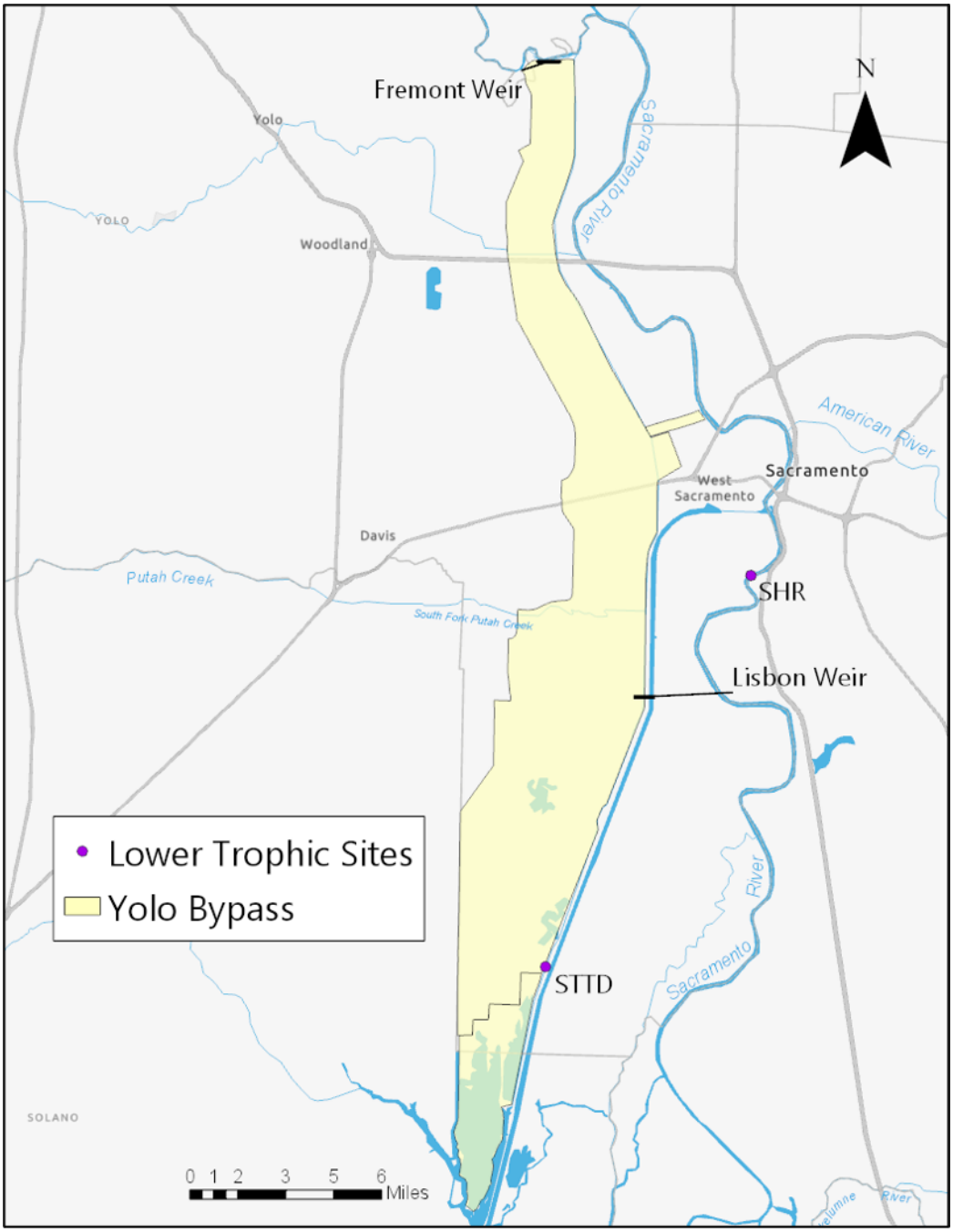
Temporal Coverage

2011-2022

Geographic Coverage



Yolo Bypass tidal slough and seasonal floodplain in Sacramento, California, USA

- North bounding coordinates (decimal degrees): 38.79395205
- South bounding coordinates (decimal degrees): 38.23466149
- East bounding coordinates (decimal degrees): -121.5368316
- West bounding coordinates (decimal degrees): - 121.8073699

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. Light attenuation (subsurface irradiance) is measured with a light meter (LI-COR LI-250A) at the surface, and at 75%, 50%, 25%, and 1% of the surface reference value in the water. The corresponding depth and measured micromoles are noted. Tide, condition of sampling (condition code), Microcystis level, and weather are also recorded with water quality parameters. Please see the YBFMP SOP on Lower Trophic Sample Collection for more details. Water Collection and Filtration Water quality samples are collected using a van dorn. Collection bottles are rinsed three times with sample water before being filled and are stored in a cooler with ice while being transported to the laboratory for filtration. For each sample of chlorophyll a and pheophytin a, between 80-500 mL of sample water is passed through a 47 mm diameter glass fiber filter with a 1.0 micrometer pore size at a pressure of 10 inches of mercury. After filtration, the filters are immediately frozen and transported to DWR's Bryte Laboratory for analysis within 48 hours of collection (Standard Methods, 19th edition).

Orthophosphate (dissolved), dissolved nitrite + nitrate, dissolved organic nitrogen, dissolved calcium, dissolved chloride, total dissolved solids, and dissolved silica surface are filtered immediately after returning to the laboratory. The samples are filtered through a 0.45 micrometer pore size mixed cellulous ester membrane filter into one-pint polyethylene bottles, one of the bottles being an actual sample bottle turned into Bryte for analysis and the other being a designated filtration bottle which is rinsed between sites that are being filtered. The filtered water either remains in the one-pint sample bottle or is transferred from the designated filtration bottle to acidified half pint bottles (one with HNO3 and one with H2SO4). All waters samples are stored in the refrigerator and the chlorophyll filter samples are stored in the freezer. All samples are then transported to Bryte Laboratory within 48 hours for analysis.

Dissolved organic carbon (DOC) samples are filtered using a metal DOC filtration system. The samples are filtered through a 45 micrometer pore size mixed cellulous ester membrane filter. A glass flask is triple rinsed with DI and then 20-30 mLs of sample water are filtered and used to rinse the flask three times. Water is then filtered and transferred to a 40 ml glass vial that is pre-preserved with phosphoric acid. Please see the YBFMP SOP on Lower Trophic Sample Collection for more details.

Sample Processing and Tracking

Sample Tracking

Samples are tracked using an internal system called FLIMS. A chain of custody (COC) listing sample number, date, time, location, and study/project is sent to Byte Labs, who check that all samples are accounted for and turned in at the correct temperature. Signatures are required of both the person responsible for dropping off the samples, and the person receiving it.

Contractor

Since July 2009 (see historical changes for more information)

DWR Bryte Labs

1450 Riverbank Road

West Sacramento, CA 95605

916 376-1959

https://water.ca.gov/Programs/Environmental-Services/Water-Quality-Monitoring-And-Assessment

Quality Assurance and Control

Instrument Specifications

All YSI ProDSS instrumentation is specified in the ProDSS Manual.

All laboratory instrumentation is listed in the Bryte Lab Quality Manual.

Calibrations

YSIs are calibrated for Specific Conductance, pH, Dissolved Oxygen, and turbidity monthly. YSI temperature readings are verified twice per year: once using a 5-point validation and once using a 2-point validation. Please see the YBFMP SOP on ProDSS Calibration for more detail. Prior to sample analysis of conventional and inorganic constituents in water, external calibrations will be made using 3 - 5 standards that cover the range of sample concentrations. The lowest standard will be at or near the Method Detection Limit (MDL). Linear regression will be <0.995 or better. Calibration verification will be run after every 20 samples after the initial calibration and will use a standard source that is different from that used for the initial calibration. Acceptable recovery for conventional analytes is 80 - 120% and for inorganic analytes is 90 - 110%.

See Bryte Chemical Laboratory Quality Manual for additional details.

Replicates/Duplicates/Blanks

Equipment blanks - A blank is created for each day of sampling for a subset of nutrient samples, for a total of two equipment blanks. DI water is used to rinse sampling equipment, and then the equipment is filled with DI water and distributed for filtering or filling non-filtered bottles. Blanks are run for: dissolved ammonia, dissolved orthophosphate, dissolved nitrate + nitrate, total kjeldahl nitrogen, and total phosphorus. Replicates - A replicate chlorophyll sample is taken for each site. The same amount of sample water as the parent sample is filtered to create this replicate sample.

Laboratory Control Samples - Laboratory control samples (LCS) provide bias information about a laboratory's ability to perform acceptable analyses on a clean matrix with the chosen methods. The LCS will be prepared by the laboratory using an aliquot of the clean matrix (e.g., water, sediment, or tissue with no detectable levels of the target analytes) that is spiked with the analytes at known concentrations. The lab results must be within 80-120% recovery or control limits based on 3 times the standard deviation of a lab's actual method recoveries for the target analytes to be acceptable.

Matrix Spikes - Matrix Spikes (MS) provide bias information on sample preparation and analysis. MS will be used to verify that the lab can determine if the sample matrix is causing either a positive or negative bias on sample results. MS samples will be prepared by the laboratory using an aliquot of the sample matrix (e.g., water sediment, or tissue) that is spiked with the analytes at known concentrations. The lab results must be within 80-120% recovery or control limits based on 3 times the standard deviation of a lab's actual method recoveries for the target analytes to be acceptable.

Matrix Spike Duplicates - Matrix spike duplicates (MSD) provide precision information on sample preparation and analysis. The laboratory will prepare separate spiked matrix samples (MS) for analysis. Acceptable lab results for bias are the same as described for matrix spikes. The duplicate values must have a RPD of less than 25% to be acceptable.

Laboratory Duplicates - Laboratory duplicates provide precision information on the analytical methods with the target analytes. The laboratory will generate the duplicate samples by splitting one sample into two parts, each of which will be analyzed separately. The duplicate values must have an RPD of less than 25% to be acceptable.

Data Quality Control

Three levels of quality control are conducted on field data:

Field data are checked by someone other than the data recorder prior to leaving each field site

Datasheets are checked while being entered into the Microsoft Access database, which has customized error-checking and data validation checks

A separate DWR staff member compares data from original field sheets to data entered into the database

DWR's Field and Laboratory Information Management System (FLIMS) is used to track water quality field and lab data from collection in the field to final use and storage. Prior to each monthly water quality run, FLIMS is used to generate the paperwork (sample identification numbers, labels, chain of custody sheets, etc.) for each field run. The data collected in the field is recorded on field sheets and is typically entered into FLIMS the next day or before samples are submitted to Bryte Lab. Staff at Bryte Lab enters laboratory data directly in FLIMS that is uploaded to the Water Data Library (WDL) when all the data for one field day has been entered. If there is missing field and lab data, discrepancies between data on field sheets and WDL, or the data does not meet quality objectives, the Lower Tropic Lead is notified and corrections are made, or the data is flagged appropriately.

Notes on Data Quality:

Please see the historical changes section for changes in sampling methods.

Archiving

Samples are disposed of once analysis is complete.

Data can be accessed on the Department of Water Resources Water Data Library: https://wdlbeta.water.ca .gov/Map.aspx

Historical Changes

Methods:

From May 2019 until November 2020: 0.45 micrometer MCE filters used for nutrient filtration (NO2+NO3, O-Phos, NH3, DON) were soaked in DI water for at least 4 hours before use. The water was changed after filters had soaked for an hour, and the hour soaking was repeated a total of 4 times.

11/19/20: Bryte updated preservation methods for some constituents. TKN, TPhos, NO2+NO3, O-Phos, NH3, and DON were previously stored in unacidified half pint bottles and frozen. The new protocol is to add 250 mLs of sample water into a bottle with H2SO4 and to store at 5 degree C.

June 2021- creation of the blank sample water was standardized. Previously a sample of DI from the lab faucet was filtered. Now the DI is passed through whichever sampling vessel was used (churn splitter or van dorn) and then added to a designated blank 1L Nalgene bottle.

June 2021- the filter used to filter the DOC sampled changed from a combusted 1 micrometer glass fiber filter to a 0.45 micrometer MCE filter. Use of a glass filtering flask and a vacuum pump was also added to the DOC filtering protocol.

October 2021- water grabs in the field are now standardized to use the van dorn in order to take a homogenized sample.

Methods References

AEU: DWR-6-SOP-024_v1.1_YSI ProDSSCalibration

AEU/Bryte: DES-1-MNL-001Bryte Lab Quality Manual version 4.0

AEU: DWR-6-SOP-015_v1.7_LowerTrophicSampleCollection

License

be guaranteed. All data are made available "as is." The Data User should be aware, however, that data are updated periodically, and it is the responsibility of the Data User to check for new versions of the data. The data authors and the repository where these data were obtained shall not be liable for damages resulting from any use or misinterpretation of the data. Thank you.

Funding

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Water Quality Table

Variables

attributeName	attributeDefinition	unit
SampleCode	sample identifier code	NA
PhysicalDataID	physical data identifier	NA
StationCode	station identifier code	NA
StationNumber	station number	NA
Datetime	date and time of measurement	NA
Date	date of measurement	NA
Year	year of measurement	NA
Month	month of measurement	NA
MonthAbb	month abbreviation	NA
Tide	tide at time of measurement	NA
Microcystis	visual rating of Microcystis in sampled body	NA
Secchi	secchi disk depth	meter
WaterTemp	water temperature	celsius
Conductivity	water conductivity	microSeimensPerCentimeter
SpecificConductance	water specific conductance	microSeimensPerCentimeter
DO	dissolved oxygen concentration in water	milligramsPerLiter
pH	pH value of water	dimensionless
Turbidity	turbidity of water	nephelometricTurbidityUnit
Flag_PQC	data flag	NA
Comment_PQC	data comments	NA

Chlorophyll/Nutrient Table

Variables

attributeName	attributeDefinition	unit
Station	station identifier	NA
Latitude	latitude of station	degree
Longitude	longitude of station	degree
Datetime	date and time of measurement	NA
Notes	notes about sample	NA
SampleCode	sample identifier	NA
Chlorophyll	chlorophyll concentration	microgramPerLiter
Pheophytin	pheophytin concentration	microgramPerLiter
DissAmmonia_Sign	dissolved ammonia sign	NA
DissAmmonia	dissolved ammonia concentration	milligramsPerLiter
DissCalcium	dissolved calcium concentration	milligramsPerLiter
DissChloride	dissolved chloride concentration	milligramsPerLiter
DissNitrateNitrite_Sign	dissolved nitrate sign	NA

attributeName	attributeDefinition	unit
DissNitrateNitrite	dissolved nitrate concentration	milligramsPerLiter
DOC	dissolved organic carbon	milligramsPerLiter
TOC	total organic carbon	milligramsPerLiter
DON	dissolved organic nitrogen	milligramsPerLiter
DissOrthophos_Sign	dissolved orthophosphate sign	NA
DissOrthophos	dissolved orthophosphate	milligramsPerLiter
TotPhos	total phosphate	milligramsPerLiter
DissSilica	dissolved silica	milligramsPerLiter
TDS	total dissolved solids	milligramsPerLiter
TSS	total suspended solids	milligramsPerLiter
VSS	volatile suspended solids	milligramsPerLiter
TKN	total kjedahl nitrogen	milligramsPerLiter
Year	year of measurement	NA
WY	water year	NA
Month	month of measurement	NA