

Yolo Bypass Fish Monitoring Program Internal Review

Phase 1 Programmatic Review

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Executive Summary

The Yolo Bypass Fish Monitoring Program (YBFMP) is a long-term monitoring program focused on the ecology of the Yolo Basin floodplain, its connectivity with the San Francisco Bay-Delta estuary, and informing management and restoration of habitat for the region's native fish species. This report details the first programmatic internal review of the YBFMP in its 22-year history; a process intended to evaluate objectives, documentation and protocols for the program, and prepare for external Interagency Ecological Program (IEP) or Science Advisory Group (SAG) reviews. This review was the first of a two-phase process, with the intention of following up with a scientific internal review to evaluate the design and scientific robustness of the monitoring program.

The phase one review evaluated 27 YBFMP components including (though not limited to) YBFMP history and background, field and laboratory documentation, permitting, contracting, regulatory support, stakeholder engagement, database management, data publication, and quality control and assurance. Staff from DWR's Aquatic Ecology Section conducted the review systematically to ensure all documentation and program components were consistently reviewed. We created a standardized template called an Element of Review (EOR) to summarize and document the reviewing process for each program element. We evaluated the program using these EOR documents to assess elements both individually and holistically, answering a series of questions to evaluate the program and summarize findings in this report. Finally, we drafted recommendations for program improvements into a prioritized list which ranged from minor revisions and organization to the creation of new documents and protocols. The review process resulted in 99 documents being examined and evaluated, including 42 left unchanged, 16 archived, 17 edited, and 24 newly created, plus 92 recommendations for improvement of the YBFMP.

As this review was the first ever completed for the YBFMP, we identified parts of the process to improve upon for future reviews. At the conclusion of the phase one review process, reviewers were asked for feedback and suggestions to improve the process in the future. We include this feedback in the conclusion of this report and make recommendations for conducting future reviews, including an outline of the goals, scope, and timeline for future reviews. Ultimately, we propose a plan to reassess program documentation annually and conduct full internal reviews of the YBFMP every five years. Our hope is that such a systematic approach to

YBFMP internal reviews will improve the overall program and assist in keeping the YBFMP adaptable and informative in an ever-changing scientific and regulatory environment.

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Abbreviations and Acronyms

Abbreviation	Meaning
ADA	Americans with Disabilities Act
AES	Aquatic Ecology Section
COC	Chain of Custody
CWT	Coded Wire Tags
DWR	Department of Water Resources
EDI	Environmental Data Initiative
EOR	Element of Review
ES	Environmental Scientist
IEP	Interagency Ecological Program
JHA	Job Hazard Analysis
LTM	Long-term Monitoring
OWQEE	Office of Water Quality and Estuarine Ecology
PWT	Project Work Team
QA	Quality Assurance
QAPP	Quality Assurance Project Plan
QC	Quality Control
RSTR	Rotary Screw Trap
SAG	Science Advisory Group
SOP	Standard Operating Procedures
SP	Standard Procedures
WQ	Water Quality
YBFMP	Yolo Bypass Fish Monitoring Program

Introduction

Background

The Yolo Bypass is a 59,000-acre floodplain near Sacramento, CA. The bypass is designed primarily as a flood management area of the Sacramento Valley and approximately doubles the wetted area of the Sacramento-San Joaquin Delta during major storm events. Supported by the Interagency Ecological Program (IEP), the Aquatic Ecology Section (AES) within the Department of Water Resources (DWR), has operated a fish and aquatic ecology monitoring program in the Yolo Bypass since 1998. The Yolo Bypass Fish Monitoring Program (YBFMP) monitors changes to the bypass ecosystem and provides abundant information regarding the significance of seasonal floodplain habitat to native fishes. 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*) as well as by California EcoRestore. Baseline data from the YBFMP are critical for informing and evaluating the success of future restoration projects mandated, or recommended, in these plans. Furthermore, the program has served to document the role of the Yolo Bypass in the life history of native fishes by providing critical baseline data on the ecology of the bypass and connections with the broader San Francisco Estuary. The program also provides valuable information on the Yolo Bypass during dry periods, when the Toe Drain of the bypass functions as a tidal dead-end slough. In addition, the YBFMP plays a significant role in helping to identify critical habitat improvements for listed species and the development of innovative management tools, highlighting the benefits of long-term ecological monitoring in assisting management of a complex ecosystem.

In the over 22-year history of the YBFMP, the program has not undergone any significant internal or external review, either from a scientific design or a programmatic perspective. Despite several IEP monitoring programs having received periodic reviews over the past 20 years via the Science Advisory Group (SAG) review process and being part of the IEP annual work planning process, the YBFMP has not had any substantial review via the IEP during its history. Regular reviews are a critical element in keeping monitoring programs adaptable, efficient, and accountable to

resource managers, regulatory staff, and stakeholders. Reviews are also essential to maintaining the robustness and relevance of the data produced and ensuring the highest quality science. The IEP Long-term Monitoring (LTM) review process, started in 2019, has set out a plan for conducting systematic reviews of IEP's core monitoring programs, as organized by target species and/or gear type, to be conducted over the next five to ten years. While the YBFMP is not currently slated to be part of this review, it is our hope that the YBFMP (or elements therein) will be reviewed through this process. In light of both this lack of historical review and anticipation of an external review, the YBFMP conducted the current internal review detailed in this report.

We planned to comprehensively review the YBFMP in two phases: (1) a Programmatic Review, as detailed in this report, which involved substantial review of program documentation and associated protocols, making recommendations for changes and additions to program documentation, and creating new program documents; and (2) a Scientific Review (planned for 2021), which will evaluate the YBFMP monitoring design for statistical power and methodology to address whether or not the program is using the right approaches to answer study questions. As an entirely internal review process, AES staff were tasked with conducting both phases of the review, with input from the Office of Water Quality and Estuarine Ecology (OWQEE) staff as needed.

Phase One Review Goals

- 1) *To prepare the YBFMP for external review:* We felt significant work was needed to prepare the program for external review, given the potential for SAG or LTM reviews and the realization that a review of any kind was overdue.
- 2) *To improve YBFMP documentation and efficiency:* Organize our programmatic documentation and create a plan for making the monitoring program more robust and transparent.
- 3) *To identify gaps in YBFMP practices and documentation and provide recommendations for improvement:* While reviewing YBFMP's documentation, we wanted to identify where documentation was lacking (either absent or insufficient) and create a plan to improve the quality and organization of existing documentation.

- 4) *To create a comprehensive narrative of the YBFMP to facilitate knowledge transfer within the program and with stakeholders:* To complement efforts to publish YBFMP data and metadata per open data best practices, we wanted to create a compendium of YBFMP knowledge and practices to provide valuable background and context for external scientists wanting to learn more about our program or use its data. This narrative will also benefit the program by increasing the efficiency of knowledge transfer to new staff and will support continuity of practices and procedures when staff leave the program.

Scope and Methods

This review was conducted March to November 2020, during the telework period of the COVID-19 pandemic. The YBFMP paused field operations on March 17, 2020, which provided staff with time to conduct a thorough and comprehensive review of the program. Therefore, the scale and timeline for conducting this internal review is not necessarily applicable, or feasible, for future reviews.

The initial scope of the phase one programmatic review thoroughly outlined the YBFMP's foundation, including: background documentation, individual field data collection protocols, and various other operational components such as QA/QC, safety, and regulatory documentation (Appendix A). A series of overarching review questions were crafted to extract meaningful and concise narratives from the review elements to assess broad program-level objectives. From there, each component identified by the initial programmatic review outline underwent systematic review, utilizing a standardized protocol for reviewing program documents. Through this process, a review document called an 'Element of Review' (EOR) was generated to summarize program documentation, identify knowledge gaps and inconsistencies, and detail areas for improvement. Additionally, the review team answered a series of overarching review questions, covering a variety of topics including organization, communication and logistics. In addition to aiding standardization of the review process, EOR documents created a comprehensive narrative of the YBFMP by summarizing and evaluating the scope and mission of the program and evaluating YBFMP integration within the broader management and monitoring framework (e.g., IEP, Biological Opinions, Incidental Take Permit). For more details about the methods used for crafting the review questions, evaluating program documentation, making recommendations, and review finalization see Appendix B: Detailed Methods.

The phase two Scientific Review, which is expected to start in 2021, will build on phase one and take a deeper examination of the technical and scientific robustness of program components and of the YBFMP as a whole. This phase two process will evaluate current methodology employed by the program and whether it is adequate for addressing the program's study questions and objectives. Finally, the results of phase two will be used to improve technical and scientific aspects of the program.

Results

Elements of Review

Due of the level of detail in each EOR, summaries of the EORs were created to capture the main points, the documents reviewed, and critical recommendations for each element. The documents and file folders reviewed during the YBFMP internal review were organized into four categories; unchanged, archived, edited, and created. The document evaluation and review process examined 99 documents, including 42 left unchanged, 16 archived, 17 edited, and 24 newly created.

- 1) *Unchanged*: refers to documents that existed prior to this internal review that were evaluated and did not receive any changes as part of the review. These documents may have been unchanged because they were satisfactory for the YBFMP's purposes, belonged to another program and therefore were not ours to edit, or edits may have been suggested as recommendations because they were over the scope of this review.
- 2) *Archived*: documents that were evaluated and determined to no longer be needed by the YBFMP, due to either outdated information or addition of information to newly created documents.
- 3) *Edited*: documents that received edits as part of the review. These edits ranged from language clarification, formatting changes, and content addition or updates.
- 4) *Created*: documents that did not exist prior to this internal review but were created based off gaps identified through the evaluation process.

The edited and created documents went through a finalization process to check for formatting consistency, grammatical errors, and content

accuracy as a concluding part of this internal review. Additionally, the review process produced 27 EOR documents and 18 other ancillary review materials. All completed EORs are available in Appendix D: Element of Review (EOR) Documents.

Summaries

History and Background

This section summarized the history, background, purpose, timeline, and publications of the YBFMP. Prior to this review, there was no official document detailing the history and background of the YBFMP but this EOR document now outlines specific details regarding the initiation of the program, the key findings, the program objectives, and the changes over time. A list of publications existed prior to this review but was updated to include the most recent additions and the YBFMP's Annual Reports. Recommendations were provided to continue updating and determining the best use of this information for the YBFMP.

Documents Reviewed:

Unchanged	Archived	Edited	Created
None	None	<ul style="list-style-type: none"> ▪ YBFMP Publications List 	None

Resource Assessment

This EOR evaluated the documentation for the funding, budgeting, and time management of the YBFMP (e.g., program funding, budget planning, project timelines, and procurements). Much of this material exists elsewhere as part of State and Departmental policy and governance, so this review focused only on aspects specific to YBFMP activities. As these processes are governed by higher level policies, no recommendations were made for creating additional YBFMP documentation for resource assessment procedures.

Documents Reviewed:

Unchanged	Archived	Edited	Created
None	None	None	None

Regulatory Support and Justification

The YBFMP is a long-term, scientific monitoring program that aims to collect baseline data of aquatic ecology in the Yolo Bypass to improve scientific knowledge of the bypass ecosystem and support a variety of regulatory mandates. Regulatory support and justification documents pertaining to these mandates inform YBFMP sampling of fish, lower trophic organisms, and water quality. This element of review compiled relevant documentation, summarized each, and recommended creating a compendium to compile YBFMP-relevant information from each regulatory document. As an early recommended action, YBFMP staff planned reviews of regulatory documents and created the first draft of the compendium document for the program.

Documents Reviewed:

Unchanged	Archived	Edited	Created
None	None	None	<ul style="list-style-type: none"> ▪ YBFMP Regulatory Support Compendium

Sample Archiving

The YBFMP archives samples collected from a variety of sampling activities. Samples are stored, preserved, or discarded based on a set of guidelines that vary from sample to sample. Sample types include phytoplankton, zooplankton, fish egg and larvae, invertebrate drift, whole fish, otoliths, fin clips, and gut contents. Documentation of Chain of Custody (COC's) and data information existed, however, no guidelines for sample archiving and storage tracking existed prior to this review. A major objective of this element of review was to organize and document the current inventory of samples and to establish standard guidelines for the lifecycle of archived samples. Archiving protocols and tracking documents were created for consistency in sample archiving across the program.

Documents Reviewed:

Unchanged	Archived	Edited	Created
None	None	None	<ul style="list-style-type: none"> ▪ YBFMP Guide to Archiving Samples ▪ AES Sample Archiving and

			Inventory Sheet
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Stakeholder Engagement

This section summarized the stakeholders that YBFMP engagement efforts focus on including collaborators, facilitated research, data consumers, educational and outreach targets, scientific community, and PWT's and working groups. Each section provided a brief list of past and current stakeholders. No documentation specific to tracking YBFMP stakeholder engagement existed prior to this review. As a recommendation, a spreadsheet will be created to document and better track stakeholder engagement efforts.

Documents Reviewed:

Unchanged	Archived	Edited	Created
None	None	None	None

Programmatic Safety

The Yolo Bypass Fish Monitoring Program performs sampling in diverse habitats including uneven terrain, riparian areas, and in open water. Most sampling is year-round or multi-seasonal in various weather conditions. Working in these adverse, unpredictable and inherently hazardous environments requires various safety trainings and documents. This element included an extensive record of safety documentation including Standard Procedures (SP), Job Hazard Analysis (JHA), and tailgate safety documents (i.e., field safety). Required training and training history tracking were outlined as well. Multiple recommendations for improving safety communication and organization were outlined for this element. Multiple documents listed in the unchanged category were external to the YBFMP and therefore outlined but not evaluated as part of this review. As part of the recommendations, it was suggested that these documents are more closely evaluated and compiled into a single, easily accessible document or (e.g., a safety manual).

Documents Reviewed:

Unchanged	Archived	Edited	Created
<ul style="list-style-type: none"> ▪ Boat Operation Protocol and Safety Guidelines ▪ Microcystis Safety Protocol 	None	<ul style="list-style-type: none"> ▪ Checklists, Sampling Plans, Boat Log 	None

<ul style="list-style-type: none"> ▪ Heat Illness Prevention Plan PowerPoint and PDF ▪ General Field Safety Plan 2018 ▪ First Aid Kits Spreadsheets ▪ AED Maintenance Log ▪ Float Plan Archive and Template ▪ Remote Work Safety Plan ▪ Incident Forms & Medical Treatment Facilities folder ▪ Safety Training Personnel Records 		<ul style="list-style-type: none"> ▪ Staff Emergency Contacts 	
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Programmatic QA/QC

This section evaluated the QA/QC system for YBFMP. Some parts of this review were redundant with YBFMP activities but were still be included here in order to facilitate a holistic assessment of YBFMP’s QA/QC program. Evaluated QA components included data QA processes, instrumentation QC/calibration, fish ID, SOP consistency, sampling effort consistency, and QAPP. A detailed list of recommendations for each QA component was created to help fill the gaps in the QA/QC system discovered by this internal review.

Documents Reviewed:

Unchanged	Archived	Edited	Created
None	None	None	None

Rotary Screw Trap

The rotary screw trap (RSTR) is installed at the lower end of the Yolo Bypass Toe Drain and typically operated weekdays during January through June to capture fish on their outmigration from the Yolo Bypass. The supporting documentation for the RSTR operation is quite extensive and has been edited and updated as part of this review to reflect the most recent changes in the SOP, metadata and safety protocols. Recommendations were made for the SOP to enhance the safety and training aspects of the operations.

Documents Reviewed:

Unchanged	Archived	Edited	Created

<ul style="list-style-type: none"> ▪ RSTR Standard Procedure ▪ Yolo Bypass Tailgate Safety Meeting RSTR ▪ Yolo Bypass Rotary Screw Trap Job Hazard Analyses ▪ Yolo Bypass Tailgate safety Meeting High Flow ▪ 2019 RSTR SP 	<ul style="list-style-type: none"> ▪ YBFMP Metadata Screw Trap 2018 ▪ AES YBFMP field to lab manual pg. 65-69 ▪ Fish Metadata EDI 	<ul style="list-style-type: none"> ▪ RSTR SOP 	<ul style="list-style-type: none"> ▪ Installation and Removal SOP ▪ RSTR Metadata
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Fyke

The fyke trap sampling program was designed to provide data on species composition and the timing and duration of adult fish migrations through the Yolo Bypass relative to different physical conditions. The main focus is on anadromous fish species (i.e. adult Chinook Salmon and sturgeon) moving through the bypass; however useful data is also collected on other fish species in the bypass. As part of this review, a new SOP and metadata document were created with updated language, protocols, and QA/QC procedures. Multiple safety documents existed prior to this review, and after evaluation, they were determined to meet the YBFMP’s safety requirements. The recommendation for this element included a video SOP and training guide for more details on fyke sampling protocols.

Documents Reviewed:

Unchanged	Archived	Edited	Created
<ul style="list-style-type: none"> ▪ Yolo Bypass Tailgate Safety Meeting Fyke ▪ Yolo Bypass Fyke Trap Job 	<ul style="list-style-type: none"> ▪ AES YBFMP field to lab manual fyke trap sampling pg. 12-14 	<p style="text-align: center;">None</p>	<ul style="list-style-type: none"> ▪ Fyke Metadata ▪ Fyke SOP

<p>Hazard Analyses</p> <ul style="list-style-type: none"> ▪ Fyke Standard Procedure ▪ Yolo Bypass Tailgate safety Meeting High Flow 	<ul style="list-style-type: none"> ▪ AES YBFMP field to lab manual fyke trap safety pg. 64 ▪ Fish Metadata EDI 		
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Beach Seine

Beach seine sampling is an integral part of the YBFMP and monitors nearshore habitat use by juvenile and smaller adult fish in the Yolo Bypass. Metadata and SOP documents were updated as part of this review to incorporate recent changes and new formatting standards for documents. Safety documents for beach seining existed prior to this review and the evaluation team determined they met department safety standards. Recommendations included updating research objectives and including more helpful visuals and guidelines within the SOP and training documentation.

Documents Reviewed:

Unchanged	Archived	Edited	Created
<ul style="list-style-type: none"> ▪ YBFMP Stations Coordinates Info ▪ Yolo Bypass Sampling Locations ▪ Yolo Bypass Seine Lengths ▪ Yolo Bypass Tailgate Safety Meeting Beach Seine ▪ Yolo Bypass Beach Seine 	<ul style="list-style-type: none"> ▪ AES YBFMP field to lab manual pg. 3-7 ▪ AES YBFMP field to lab manual Beach Seine Safety pg. 59 ▪ Fish Metadata EDI 	<p>None</p>	<ul style="list-style-type: none"> ▪ YBFMP Metadata Beach Seine ▪ Beach Seine SOP

Job Hazard Analyses <ul style="list-style-type: none"> ▪ Beach Seine Standard Procedure ▪ Yolo Bypass Tailgate Safety Meeting High Flow 			
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Egg and Larval

Egg and larval sampling is important for informing annual recruitment in Yolo Bypass. Metadata and SOP documents existed prior to this review however they were outdated so new documents were created to reflect the most recent changes for the egg and larval sampling effort and document formatting. The egg and larval SOP will be added to the combined lower trophic SOP as a result of this review. Due to sampling changes over the past few years where sampling at Sherwood harbor in the Sacramento River is no longer conducted, it is highly recommended that the research questions are updated to reflect the appropriate egg and larval sampling objectives. Other recommendations included using consistent language for egg and larval sampling documents.

Documents Reviewed:

Unchanged	Archived	Edited	Created
<ul style="list-style-type: none"> ▪ Yolo Bypass Tailgate Safety Meeting Lower Trophic Sampling ▪ Yolo Bypass Lower Trophic Sampling Job Hazard Analyses 	<ul style="list-style-type: none"> ▪ Egg and Larval Metadata 2019 ▪ Yolo Egg and Larval Evaluation SOP 	None	<ul style="list-style-type: none"> ▪ Egg and Larval Sampling Metadata ▪ Egg and Larval Sampling SOP

<ul style="list-style-type: none"> Lower Trophic Sampling Standard Procedure 			
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Zooplankton

Fixed zooplankton nets (150 micron and 50 micron mesh) are used to collect zooplankton samples from the Yolo Bypass Toe Drain, and the Sacramento River at Sherwood Harbor. Since the YBFMP zooplankton metadata document was published and recently updated on the Environmental Data Initiative, it required minimal revision for this review. As a result of this review, an updated SOP was created and will be added to the combined lower trophic SOP. Multiple recommendations were made to improve QA/QC of zooplankton sampling documents through tracking changes made to documents and clarifying standardized details of methods. The standard procedure document provides details on safety measures required for zooplankton sampling, while the SOP includes training materials for sampling and processing samples.

Documents Reviewed:

Unchanged	Archived	Edited	Created
<ul style="list-style-type: none"> Lower Trophic Sampling Standard Procedure 	None	<ul style="list-style-type: none"> Zooplankton Sampling Metadata 	<ul style="list-style-type: none"> Zooplankton Sampling SOP

Phytoplankton

The Yolo Bypass Field Monitoring Program (YBFMP) conducts bi-weekly lower trophic sampling at 3 sites around the Yolo Bypass: Lisbon Weir, Screw Trap (in the Toe Drain), and Sherwood Harbor (Sacramento River). The objective of phytoplankton sampling in Yolo Bypass is to collect baseline data on phytoplankton community composition and abundance in the bypass, which is a net source of phytoplankton to the San Francisco Estuary food web during certain times of year. The original SOP for phytoplankton sampling lacked necessary detail on procedures, safety, and objectives. As part of this review, a new phytoplankton sampling SOP was created. Recommendations were made for documenting changes to metadata and for improving COC tracking information.

Documents Reviewed:

Unchanged	Archived	Edited	Created
None	<ul style="list-style-type: none"> ▪ Non-filter SOP 	None	<ul style="list-style-type: none"> ▪ Phytoplankton SOP

Water Quality

The water quality (WQ) element of the YBFMP is divided into two sections; (1) Discrete and Continuous environmental monitoring, and (2) nutrient and chlorophyll water sample analysis. Discrete and continuous environmental monitoring uses YSI ProDSS and EXO2 instruments, respectively, to measure water quality parameters. Nutrients and chlorophyll are collected as part of the YBFMP lower trophic sampling program, and samples are analyzed by the Bryte Chemical Laboratory (DWR). Multiple existing WQ documents were used to create an updated SOP. WQ sampling followed a WQ sampling document created by the DWR QA committee; ultimately, this document was used to create a new YBFMP WQ SOP and will contribute to the recommended creation of metadata.

Documents Reviewed:

Unchanged	Archived	Edited	Created
<ul style="list-style-type: none"> ▪ Chlorophyll Metadata ▪ Plan Submittal Containers ▪ SOP WQ Sample Collection for Laboratory Analysis Final ▪ YBFMP Stations Coordinates Info ▪ YSI ProDSS Handheld SOP ▪ YSI ProODO SOP 	<ul style="list-style-type: none"> ▪ Standard Operating Procedures for the Collection and Filtration of Chlorophyll Samples ▪ AES YBFMP field to lab manual pg. 15-16 ▪ NonFiltr SOP ▪ churn splitter and blank SOP 	None	<ul style="list-style-type: none"> ▪ Water Quality Measurements SOP

<ul style="list-style-type: none"> ▪ YSI Pro DSS calibration cheat sheet ▪ Saturated Magnesium Carbonate Solution SOP ▪ YBFMP LT Bottle Prep and Post Fieldwork ▪ Lower Trophic Data Entry SOP 			
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Drift Invertebrate

A rectangular surface net is used to collect drift invertebrate samples at one site in the Yolo Bypass (rotary screw trap) and one site in the Sacramento River (Sherwood Harbor), year-round, twice a month, or once a week (during floodplain inundation). Samples from both locations are taken within the same week. The Lower Trophic Sampling SOP briefly described the steps and safety precautions to perform drift invertebrate sample collection, so a new more detailed and specific SOP was created. The reviewed metadata document provided the appropriate information on the program’s background, sampling locations, methods, contractors, data, and changes over time.

Documents Reviewed:

Unchanged	Archived	Edited	Created
None	<ul style="list-style-type: none"> ▪ AES_YBFMP field to lab manual 	<ul style="list-style-type: none"> ▪ Lower Trophic Sampling SOP ▪ Invertebrate Drift Metadata 	<ul style="list-style-type: none"> ▪ Invertebrate Drift SOP

Listed Species Handling

The Yolo Bypass Fish Monitoring Program collects data on several listed species including spring and winter run Chinook Salmon, Coho salmon, Delta Smelt, Longfin Smelt, Central Valley Steelhead, and Green Sturgeon. When caught, these species require special handling and sampling procedures to minimize stress and to safely allow collection of valuable

information. Prior to the review, listed species handling was outlined in a listed-species handling guidelines document known as a “take cheat sheet”. A SOP was created as part of the review to incorporate relevant information from the previous “cheat sheet”, include updated current practices, and to ensure listed species handling follows permitting requirements. Additionally, the SOP includes field safety guidelines for staff and research questions regarding this element.

Documents Reviewed:

Unchanged	Archived	Edited	Created
<ul style="list-style-type: none"> ▪ 2020 Genetic Sampling and Take Cheat Sheet 	<ul style="list-style-type: none"> ▪ YBFMP Field to Lab Manual Sections 2C & 3C 	None	<ul style="list-style-type: none"> ▪ Listed Species Handling SOP

Data Publication

While the Yolo Bypass Fish Monitoring Program (YBFMP) only began publishing data online in 2018, reports on the monitoring program’s datasets have been published in the IEP newsletter since 2012. Current datasets, in addition to metadata and data processing code, are published on the Environmental Data Initiative (EDI), a curated open-access website sponsored by the National Science Foundation, where they obtain a digital object identifier (DOI) to facilitate public accessibility and data sharing. Open-access data publication is relatively new to the YBFMP, so the program often uses external resources (e.g., online publishing instructions) for data publication. No internal, YBFMP-specific, guidelines existed prior to this review, therefore, a SOP/guideline document was created as part of this review and recommendations were made to improve this document as more datasets are published in the future. For example, adding QA/QC protocols for data publication are currently being developed and updated as recommended in the EOR.

Documents Reviewed:

Unchanged	Archived	Edited	Created
None	None	None	<ul style="list-style-type: none"> ▪ Data Publication SOP

Coded Wire Tag Recovery

At their hatchery of origin, a portion of hatchery juvenile salmon are injected with a small piece of narrow-gauge wire, laser-printed with a numeric code, that references the location and time of release. In addition to these coded wire tags (CWT), these fish are marked by clipping the adipose fin to help identify potentially CWT-implanted fish in the field. When these fish are caught by the YBFMP, they are taken to the lab to recover and record the CWT. The CWT SOP describes protocols for extraction, data recording, and reporting. It is used for training or reference, and was updated with research questions, safety measures, and QA/QC measures.

Documents Reviewed:

Unchanged	Archived	Edited	Created
None	None	<ul style="list-style-type: none"> ▪ CWT Recovery SOP 	None

Dissection

Smelt, fall/late-fall/spring-run Chinook Salmon, and other juvenile fish species of interest are preserved for laboratory analyses. Fish dissections are conducted based on the species and, for salmon, the presence of adipose fins. The SOP and Standard Procedure documents for dissections were evaluated and updated as part of the review. These documents are used for training or reference, and include research questions, QA/QC measures, and changes over time.

Documents reviewed:

Unchanged	Archived	Edited	Created
None	None	<ul style="list-style-type: none"> ▪ Fish Dissection SOP ▪ Dissections SP 	None

Genetics

Genetic verification is done for species of interest sampled by the YBFMP. The species of interest genetically analyzed include juvenile and adult Chinook Salmon, Sacramento Blackfish, lamprey, Delta Smelt, Longfin Smelt, and Wakasagi. This EORs document evaluation found outdated information in for genetics sampling and, as part of this review, they were combined and updated into one SOP which included information on safety

guidelines, QA/QC protocols, and research objectives. No metadata document for genetics existed prior to this review, however, one was created during the review and included background and site information, sampling methods, QA/QC protocols and changes over time to the program. Recommendations were made to improve sample and data tracking when the program transitions to the new database.

Documents Reviewed:

Unchanged	Archived	Edited	Created
None	<ul style="list-style-type: none"> ▪ Fish DNA Sample Collection Protocol ▪ Tissue and Fish Sample Collection Protocol ▪ Fish Tissue Sampling for Osmerid/Smelt SOP ▪ Fish Tissue Sample Labeling SOP ▪ Tissue collection for DNA studies SOP ▪ 2016 CHN DNA Collection Protocol SOP ▪ Protocols for Yolo Bypass ERP Tissue Collections 	<ul style="list-style-type: none"> ▪ Species of Interest Genetics SOP 	<ul style="list-style-type: none"> ▪ Genetics Metadata

Contracting

Contracts are used for services that cannot be conducted within the Aquatic Ecology Section (AES) of DWR and are managed by AES staff with

assistance from DWR's contracting department. Current contracts are for water quality analysis, zooplankton identification, drift invertebrate identification, ichthyoplankton (egg and larval) identification, phytoplankton identification, fish genetic identification, and fish gut analysis. Minimal YBFMP-specific supporting documentation existed prior to this review. However, contracting documentation and training existed at a department-wide level. To support YBFMP contract management, a contracting SOP was created, and recommendations were made to create a system for tracking contracting changes.

Documents Reviewed:

Unchanged	Archived	Edited	Created
None	None	None	<ul style="list-style-type: none"> ▪ Contracting SOP

Permitting

The YBFMP requires several permits for sampling including a scientific collection permit, National Marine Fisheries Service Endangered Species Act permit, Fish and Wildlife Service Endangered Species Act permit, Marine Mammal Protection Act permit, and California Endangered Species Act Memorandum of Understanding (MOU). Sampling is only conducted within the scope of what is covered in these permits, and physical copies of all relevant sampling permits are required anytime sampling is conducted. The Permitting EOR documented the scope of each permit that is required for the YBFMP and provided links to related documents and the updated Take Reporting SOP.

Documents Reviewed:

Unchanged	Archived	Edited	Created
None	<ul style="list-style-type: none"> ▪ End of the Year Reporting Guide 	None	<ul style="list-style-type: none"> ▪ Take Reporting SOP

Database Management/Data Lifecycle

Previous YBFMP documentation did not comprehensively track the full lifecycle of data or database changes. The need for a SOP and ways to track and document database changes were identified as part of this review. Given that YBFMP is currently transferring data to a new database platform,

database management for the program is evolving. Therefore, the recommendations for this EOR were intended to be completed with the transition to the new database.

Documents Reviewed:

Unchanged	Archived	Edited	Created
None	None	None	None

Digitizing and Archiving Hard Copy Documents

Hard copy documents such as field data sheets and Chain of Custody (COC) forms are digitized to ensure data and documents are not lost if originals are lost or compromised. Recommendations from this EOR noted that the current computer folder containing scanned datasheets needs updating to include missing data sheets from past years. As part of this review, a SOP was created to facilitate training and as reference for the process of digitizing and archiving hard copy documents.

Documents Reviewed:

Unchanged	Archived	Edited	Created
<ul style="list-style-type: none"> ▪ Scanned Data Sheet Archive 	None	None	<ul style="list-style-type: none"> ▪ Digitizing Hard Copy of Datasheets SOP

Personnel Timeline

The personnel timeline is a collection of all AES personnel, their start and end date, position, and role. No comprehensive or centralized documentation of personnel within the program existed prior to this review, so a new document was created. The new personnel document is intended to be kept up to date with each new employee.

Documents Reviewed:

Unchanged	Archived	Edited	Created
None	None	None	<ul style="list-style-type: none"> ▪ Personnel Timeline List

Equipment Purchasing and Maintenance

The YBFMP uses a variety of sampling equipment that needs to be maintained to ensure it continues to function properly and provide reliable, quality data. New sampling equipment is often purchased from specific

vendors to ensure consistency in sampling gear, so documents related to these vendors and purchasing details are especially useful for purchasing new equipment. Prior to this review, only a few equipment maintenance protocols were detailed in existing sampling SOPs. As part of this review, a general SOP of the purchasing process and maintenance schedule for most YBFMP activities was created to fill the gaps left by other SOPs. A new YBFMP Equipment and Consumables spreadsheet was also created to help facilitate future equipment purchases. Recommendations were made for updating new documents and reorganizing the structure of shared drive folders.

Documents Reviewed:

Unchanged	Archived	Edited	Created
<ul style="list-style-type: none"> ▪ AES Vehicle & Vessel Folder ▪ Instrument Manual and Maintenance Folder ▪ YSI Continuous Data Folder 	None	<ul style="list-style-type: none"> ▪ Purchasing Folder 	<ul style="list-style-type: none"> ▪ Equipment Purchasing and Maintenance SOP ▪ YBFMP Equipment and Consumables spreadsheet

Sample Transfers

Invertebrate drift, egg and larval, and zooplankton samples are collected, preserved, and transferred for YBFMP lower trophic sampling efforts, before being shipped to contractors for analysis. Invertebrate drift and egg & larval samples are first preserved in formalin in the field, then transferred to ethanol before shipping to a contractor for taxonomic identification and enumeration. Zooplankton samples are preserved in formalin in the field and transferred to Lugol’s Iodine solution before shipping to a contractor for taxonomic identification and enumeration. The SOP for sample transfers was updated during this review for clarity on the most up to date protocols. SOPs for mixing and handling chemicals for sample transfers were separated into multiple SOPs. Chain of Custody (COC) documents are critical to managing and tracking samples sent to contractors. Therefore, a sample tracking flowchart was created as part of this review to help explain the sample tracking process.

Documents Reviewed:

Unchanged	Archived	Edited	Created
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None	None	<ul style="list-style-type: none"> ▪ Sample Transfers SOP ▪ Sample Transfers SP ▪ 10% Formalin SOP ▪ 70% EtOH SOP ▪ 8% Lugol's Iodine Solution SOP 	<ul style="list-style-type: none"> ▪ Lower Trophic Sample Tracking Flowchart
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Review Questions

1. Are YBFMP goals and objectives explicitly clear and identified?

a) Are goals and objectives easily found and publicly accessible?

Prior to this review, goals and objectives of the YBFMP were not easy to find. In response, prior documentation was surveyed and all existing language describing program goals was assembled into the internal review report, namely the History and Background Element of Review (EOR). To improve accessibility of goals in the future, we recommend including program goals in more locations such as the combined SOP book, metadata documents, fact sheets, and the future IEP website.

b) How does YBFMP manage changing goals and objectives to facilitate adaptive management, new stakeholders, and responsiveness to new regulatory mandates?

The YBFMP does not currently have a formal process to manage changing objectives. The program has largely relied on informal internal audits to address data needs and gaps related to evolving management and stakeholder interests. One example of this is how the program began incorporating genetic analysis into fish identification to improve accuracy for permit reporting of threatened and endangered species. The Regulatory Support and Justification and the Stakeholder Engagement EORs further detailed changes the program has made to respond to shifting goals and objectives. To address future changes in a more

structured way, members of the program will evaluate this question regularly during the annual program check-in.

2. Are data disseminated to users in useable formats and in relevant time periods?

- a) Are data collection methods documented in a thorough, useful, transparent, and accessible way (e.g., sample and data archiving)?

YBFMP data collection methods were not always well documented. However, over the past couple years, members of the program have become involved in the IEP Data Utilization Workgroup (DUWG) and the DWR Quality Assurance (QA) group. With assistance from these groups and through the internal review process, the program has updated its metadata and SOP documents to be more transparent and thorough with standardized templates. Our review highlighted that some practices were not documented, so new SOPs were created. The review also found that some of our documents were out of date, and we recommended that these documents be updated more regularly as part of our annual program check-in. Furthermore, all documents were formatted to be ADA compliant. More details about the program's data publication processes can be found in the Data Publication EOR.

- b) Has the YBFMP identified and documented data limitations?

The program has a variety of data limitations, which are addressed in the "Notes on Data Quality" section of each metadata document. During the internal review, several staff members contributed to identifying data limitations for each metadata document. While this helped us to recognize self-identified limitations, there are likely further limitations which we hope to discover. These will be explored through the Phase Two scientific program review and the preparation process for publishing data to the Environmental Data Initiative (EDI) repository.

- c) What is the frequency of peer-reviewed publication and report writing?

Information on the YBFMP annual fish catch is published in the IEP Newsletter as a status and trends report for each water year. Lower trophic data previously was reported less frequently in

reports that spanned several water years. Moving forward, the YBFMP will publish the fish and lower trophic status and trends reports annually within the same newsletter issue. Peer-reviewed publications happen on a less prescriptive timeline. A summary of all program reports and publications can be found in the History and Background EOR: Publications List.

3. Is YBFMP data being used to inform restoration and management of the Yolo Bypass, and if so, how is the information communicated?

Data from this program is used to inform restoration and management of the bypass, however, this contribution was previously not well documented. As a part of this internal review, we identified relevant documents outlining and describing the way YBFMP data has been or could be used. These documents (such as the Wallace and Fremont Weir Biological Opinions) are now a part of a Regulatory Support & Justification “journal club” within the program. The goal of this journal club is to better understand and document how the program contributes to restoration and management actions. The final deliverable will be a detailed compendium outlining the various relevant regulatory and science guidance documents and the nexus between them and the YBFMP.

4. Are YBFMP data and results communicated to, and used by, the scientific community, stakeholders, and managers? Are the data and results communicated in a way that is useful?

YBFMP data and results are largely communicated through data publishing, annual reports, scientific publications, and oral and poster presentations at scientific conferences. The Data Publication EOR and Stakeholder Engagement EOR document these efforts in detail. The Stakeholder Engagement EOR also documents the collaborative and external studies which have utilized YBFMP data. However, while the program communicates its data and results often, there was previously no plan for how it would gauge the efficacy of these communication routes. As part of an office-wide communication effort, separate from this internal review process, the YBFMP created a Communication

Plan with suggestions for sustaining and assessing the communication of results and data. We believe this plan will help fill some of the gaps identified in this review, but we also recommend continuing to document collaborations, as was done as part of the Stakeholder Engagement EOR.

5. Who does YBFMP collaborate with or assist with sample collection?

- a) How do these collaborations originate, and how are the relationships communicated and documented?

Most collaborations originate organically, through connections and communication with various groups. Publishing and reporting YBFMP data and results helps foster these connections by making potential collaborators aware of the program and its associated data. Prior to this review, the program did not formally document its collaborative work. During the review, these relationships and projects were recorded in the Stakeholder Engagement EOR and we recommended that the program maintain the list created in the EOR to track future collaborations.

- b) What are the range of products from these collaborations?

The products of these collaborations include further data, publications, presentations, and synthesis projects. These products were not well tracked in the past but were identified and documented in the Stakeholder Engagement EOR. As a result of this review, we recommend better tracking and documentation of these products and which collaborations they originated from.

Conclusions

Summary of Recommendations

At the end of each EOR, a 'Recommendations for Improvement' section was included to allow review teams to make suggestions as to how the program could be improved after evaluating the element. The review coordination team ranked these recommendations to facilitate the implementation process when addressing recommendations in the future.

Rankings included high, medium, and low priority, and discussion topics. After each ranking was defined, all recommendations were assessed and then ranked accordingly. In some cases, tasks relied on other tasks being completed first, so those may require a different timeline. For example, some recommendations must be completed after the YBFMP implements their new database. To view the priority ranking descriptions and all recommendations made during the review, see Appendix E: Master Recommendations List.

The recommendations made throughout the review varied greatly based on the EOR. However, common themes were quality assurance/quality control, safety, accessibility, and tracking or maintaining records. While the YBFMP had some quality assurance and quality control protocols prior to this review, the recommendations reflected that many of them could be improved or better documented. Though YBFMP safety procedures meet department standards, our recommendations involved adding more documentation and tracking. Our recommendations also addressed improving the organization of where documents are stored (both physical and network locations), adding photos and links to supporting documents in standard operating procedures to improve understanding, creating documents for program components not formally documented in the past, and standardizing training for new employees. Finally, we identified many elements in the YBFMP that could benefit from improved document tracking.

YBFMP staff is working through completing all 92 recommendations from this review and have developed a plan to implement and track this progress. All recommendation topics will be coordinated and discussed during biweekly YBFMP coordination meetings so that staff are informed and engaged in the progress of implementing recommendations. If additional items are proposed during this implementation period, they will be tabled for completion at a later date, after the initial recommendations are completed. The YBFMP will aim to complete four to six recommendations per month, with a goal of completing the entire list by December 2021. One environmental scientist and one scientific aide will oversee tracking and determining which recommendations will be collaboratively worked on each month. In an effort to keep program documentation up to date and ease the time requirement for future reviews, AES will meet annually to check in and update all relevant documents (see below). The first annual meeting in July

2021 will serve as a recommendation list check-in to go over the progress made and, if necessary, reevaluate our completion goal.

Future Reviews and Lessons Learned

While the review effort presented in this report is the first systematic review of the Yolo Bypass Fish Monitoring Program in its 22-year history, it is not meant to supplant or pre-empt additional internal reviews, external reviews, or more frequent review updates. On the contrary, this effort is intended to “grease the skids” for future reviews by strengthening YBFMP documentation and organization. The vision for YBFMP review following this report is three-fold: 1) to lay the groundwork for a comprehensive and independent external review via the Interagency Ecological Program or other external entity, 2) to prepare YBFMP staff for conducting the phase two internal review (outlined above), and 3) to set a baseline for regular, recurring reviews of YBFMP documentation.

With respect to regular, recurring reviews of YBFMP documentation, our vision is:

- 1) To conduct annual check-ins on YBFMP documentation. These check-ins would occur every summer and involve staff revisiting program SOPs and metadata documents to ensure they remain up-to-date and reflective of current practices. These check-ins would not be in-depth evaluations, but merely an effort to make sure written materials still accurately represent program activities. Per quality assurance best practices, documentation should be immediately updated if any changes to protocols are required, so this annual check-in serves to ensure accurate documentation.
- 2) To conduct an update to this phase one review every five years, in which YBFMP staff systematically revisit all EORs and program documentation. This 5-year recurring review will function to: 1) update all program documentation not updated during the annual check-ins, 2) examine YBFMP documentation holistically to identify any gaps or duplication in documentation that may have arisen since the previous review, and 3) critically review all program documentation to ensure that it continues to meet its intended purpose effectively and efficiently. We envision that the upcoming phase two scientific program review would also be updated every 5 years after completion. Therefore, review updates for phase one and two would occur in two consecutive years followed by three years of annual check-ins for both.

Future review efforts, including the 5-year review updates and the phase two review, as well as other monitoring programs seeking to carry out a similar review effort, will benefit from lessons learned during our phase one review. The following suggestions are provided with these goals in mind:

- Organization and planning for reviews is critical and should be prioritized.
- Clearly define roles and responsibilities for all staff up front.
- Hold scoping meetings with all staff prior to starting any review to ensure a cohesive vision.
- Form a core leadership team from the outset. Three people, including the supervisor, worked well for this review.
- Review questions should be drafted in coordination with all staff and should be incorporated into the review at an early stage. It is possible that each 5-year review update would have a mix of revisited and new questions to encourage a critical assessment. These questions should be utilized when outlining the scope of each review.
- Identify all review products at the outset to better manage time and resources.
- Have at least one staff member as part of all review activities to ensure consistency and avoid duplication. Feedback from this person can then be routed through the review leadership team so that everyone is on the same page and discrepancies can be addressed.
- Have regular check-in meetings with the full team to answer questions, talk about progress, and communicate process and scope adjustments.
- Utilize SharePoint, or whatever analog is available, to facilitate simultaneous review activities and promote cohesiveness and organization.
- Detailed and transparent record keeping and tracking of review progress is critical.
- Having detailed examples and templates helps facilitate consistency and prevent confusion.
- Budget adequate staff time and manage deadlines appropriately.

The goal of both the annual check-ins and the 5-year review update is to create a system of updates and reviews that sets the YBFMP on a sustainable long-term path of maintaining its status as a high-quality scientific monitoring program. The level of effort needed to conduct the review outlined in this report was significant and would have been

challenging to implement if it was not for the temporary suspension of fieldwork associated with the COVID-19 pandemic response. This kind of opportunity will likely not repeat itself and the YBFMP should endeavor to prioritize regular updates and reviews so that the effort to complete future reviews is reasonable and sustainable.

To ensure that information gleaned from this review could be used in the most constructive way possible, an important final step was to assess feedback from the review team on the utility of undergoing such a process. In particular, the review team was asked to identify aspects of the review which proved useful either to them, or which they felt could be useful to others, including within the current section staff or future staff and other groups seeking to undergo similar efforts. Aspects of the review identified as particularly beneficial were:

- Identifying information and knowledge gaps and creating new documents to fill any gaps.
- Organizing program documentation to ensure documents are easy to locate for any staff.
- Updating and standardizing documents, especially standard operating procedures and metadata documents, and a more comprehensive implementation of quality assurance and accessibility standards for documents.
- Creating document lists and summaries to provide a detailed, easy-to-reference overview of the program and its associated documentation.

This list is a brief summary of some of the positive outcomes of undertaking such a review. Others will likely find different benefits when conducting their own review, specific to each program and its history, and the individual participants in the review process itself. Nonetheless, we believe that a comprehensive program review is an important tool for assessing and re-examining program objectives, implementing program-wide quality assurance, and organizing program documentation. This is particularly true for long-term monitoring programs like YBFMP. While our review was extensive; we believe that undertaking such a process is an excellent way to develop a collaborative and constructive program that is able to better adapt to complex physical and regulatory environments.

Acknowledgements

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