

Compendium of Resources, Protocols, and Guidelines for Environmental Monitoring

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Introduction

The purpose of this compendium is to provide guidance to project proponents and programs with the intent to enhance habitat restoration monitoring and data management in the San Francisco Bay/Sacramento–San Joaquin Delta Estuary (Bay-Delta) by providing a short overview of available resources and facilitate coordination in approaches among efforts. This compendium is not intended to be an exhaustive list of all resources, protocols, and guidelines for environmental monitoring, but serves as an overview of the more widely used efforts projects and programs should be aware of as a monitoring steward in the Bay-Delta.

Large-scale environmental questions, such as the success of restoration programs, whether recovery objectives for species are met, or the effects of climate change, increasingly require pooling and analysis of different sets of data from multiple individual monitoring efforts. However, data sharing, combining, and comparing across different programs and projects cannot be accomplished without compatible and adequately documented monitoring and data management approaches.

This compendium, a living document, was drafted in a collaborative approach. Staff of multiple agencies and organizations provided review and input, including staff from the member agencies of the [California Wetland Monitoring Workgroup](#) (CWMW), the [Interagency Adaptive Management Integration Team](#) (IAMIT), and the [Delta Science Program](#) (DSP). It is intended to serve as a resource that could be shared with partners implementing conservation programs and projects, such as conservation project managers (for example, Grant Programs applicants), and conducting environmental studies. This compendium is meant to aid but not replace the guidance individual projects would receive during the regulatory process. As such, it summarizes existing guidance, standard operation procedures (SOPs), and protocols that are widely applicable and used as being potentially useful for facilitating the sharing, combining, and comparing of data across many different programs and projects. For example, the Delta Science Plan calls for improving the organization and accessibility of scientific information to yield useful and useable information for decision-makers. This document is not intended to provide an overview of ongoing monitoring activities and their specific monitoring approaches or data systems.

Sacramento-San Joaquin Delta Conservancy staff welcome suggestions regarding additional protocols and guidelines that could be incorporated into the next version of this document, as well as information on updates to those already identified. Please contact thomas.jabusch@deltaconservancy.ca.gov.

This compendium is consistent with the concepts and terms of the [State Wetlands and Riparian Area Monitoring Plan](#) and uses the three-level classification system developed by the U.S. Environmental Protection Agency (USEPA).

Monitoring and Data Management Resources for Effectiveness Monitoring

This compendium is focused on habitat restoration projects and presents available resources for creating robust monitoring plans that are compatible and consistent with the Wetland and Riparian Area Monitoring Plan (WRAMP) and its associated tools, including EcoAtlas and the California Rapid Assessment Method (CRAM). WRAMP follows the concept of a Level 1, Level 2, and Level 3 approach to monitoring and provides the framework for making these three levels of assessment work together in the analysis of the overall condition and viability of aquatic resources (such as wetlands, streams, and riparian areas). Implementing the WRAMP Framework allows us to establish a baseline in resource extent, condition, and function; detect change; and characterize trends over time. A central aspect of the WRAMP framework is the classification of environmental monitoring data, their methods of collection, and their stated purposes into Level 1, Level 2, and Level 3:

- Level 1 – Remotely sensed and Geographic Information System (GIS)- or model-derived landscape-scale assessment: aquatic resource and project inventories;
- Level 2 – Field-based rapid assessment of the condition of aquatic resources at the project or site scale;
- Level 3 – Field-based intensive site assessment of specific resource function and condition (e.g., biological assessment, water quality evaluation, diagnosing the cause of degraded conditions).

MORE INFORMATION

- [Elements of WRAMP \(California Water Quality Monitoring Council\)](#)
- [WRAMP Guidance and Frequently Asked Questions \(FAQs\)](#)

Level 1 – Landscape Assessment

Level 1 assessments are not field-based and are focused at the landscape or watershed scale. Level 1 data pertain to spatial relationships that can be quantified or visualized through maps and imagery. They answer questions about the location, distribution, abundance, and diversity of aquatic resources and related projects in the watershed or landscape context. Typical Level 1 data include GIS-based inventories of aquatic resources such as wetlands and streams, restoration projects, and landscape metrics, as well as map-based displays of Level 2 and Level 3 monitoring data at the watershed or landscape scale. Predictions and forecasts of condition based on conceptual and numerical models are also Level 1, although they may be based on Level 2 and Level 3 data.

Level 1 Monitoring

Level 1 data are typically gathered through remote sensing. Future versions of this compendium may include an overview of relevant data products and resources for remote sensing-specific methods and best practices, data quality criteria, and image processing.

Level 1 Data Management

California EcoAtlas

Purpose

Provides public access to information for effective aquatic resource management. Helps visualize and summarize information about the distribution, abundance, diversity, location, and condition of California wetlands, streams, and riparian areas.

California Aquatic Resource Inventory (CARI)

[Viewable on EcoAtlas.org](#)

Purpose

Statewide GIS of surface waters and riparian areas standardized to a common classification system. Provides standardized mapping protocols.

Application

Updateable basemap for EcoAtlas and other Level 1 tools, including Project Tracker and the Landscape Profile Tool, and used as a sample frame for Level 2 and Level 3 assessments.

Resources

STANDARD OPERATING PROCEDURES (SOPS)

A comprehensive statewide CARI guidance document is not yet available. However, the mapping documentation for the Bay Area Aquatic Resources Inventory (BAARI) provides a detailed template for mapping and classifying surface waters consistent with standards provided by the Federal Geographic Data Committee (FGDC) and with enough detail and accuracy to inform local land use plans. The Delta Aquatic Resources Inventory (DARI), for example, is currently being developed and applies the same standards and methodology.

- [BAARI Mapping Documentation](#)
- [BAARI Standards and Methodology for Stream Network, Wetland, and Riparian Mapping \(Portable Document Format or PDF\)](#)

CARI EDITOR TOOL

Submit suggested updates, deletions or additions of stream and wetland features classified in CARI:

- [CARI Editor Tutorial](#)

RIPZET TOOL AND USER'S MANUAL

Estimate the extent of riparian areas for different sets of riparian functions:

- [Download RipZET Tool and User's Manual](#)

CARI DATA

- [California Aquatic Resource Inventory \(CARI\)](#)

CONTACT

- [Email to ecoatlas@sfei.org](mailto:ecoatlas@sfei.org)

Habitat Project Tracker

[Viewable on EcoAtlas.org](#)

Purpose

Project Tracker is a data management system for information on wetland restoration, mitigation, and habitat conservation projects throughout California. Once projects are approved for public display by regional managers, they can be viewed and downloaded along with other projects and data layers on EcoAtlas. Providing tools to track and analyze landscape change will improve the ability to strategically conserve important habitats in the future.

Application

[Project Tracker](#) features a data entry tool for uploading and editing project information. Improved tracking and mapping of project activities will allow for better analyses of changes in habitat extent, landscape-scale conservation planning, evaluation of progress towards meeting conservation objectives, and leveraging of restoration resources.

Resources

CONTACT

- [Email to ptrackadmin@sfei.org](mailto:ptrackadmin@sfei.org)

Level 2 – Rapid Assessment

This level of monitoring focuses on questions and data about the condition of habitats using rapid field assessments. Level 2 field assessments include methods that are qualitative or semi-quantitative and do not rely on the collection of field materials or any laboratory analysis. Prominent Level 2 methods used in California include the CRAM for assessing the health of wetlands and streams and Proper Functioning Condition (PFC), but other assessment methods are also available.

Level 2 Monitoring

California Rapid Assessment Method (CRAM)

Purpose

CRAM is a cost-effective and scientifically defensible rapid assessment method for monitoring the conditions of wetlands throughout California. It is designed for assessing ambient conditions within watersheds, regions, and throughout the State. It is also used to assess the performance of compensatory mitigation projects and restoration projects.

Application

CRAM enables trained practitioners to assess the overall health of a wetland by choosing the best-fit set of narrative descriptions of observable conditions ranging from the worst commonly observed to the best achievable for the stream or wetland type being assessed. CRAM is supported by a training program with multiple classes each year and a statewide database of practitioners.

Resources

CALIFORNIA RAPID ASSESSMENT METHOD WEBSITE

- Provides [resources for CRAM](#) use and applications, training, and SOPs.

CONTACT

- [CRAM](#)
- [Trained Practitioners](#)
- [USEPA Wetlands](#)

Proper Functioning Condition (PFC)

Purpose

PFC is a qualitative assessment based on quantitative science. Its purpose is to develop information about whether a wetland-riparian area is physically functioning in a manner that will allow the maintenance or recovery of desired values over time; determining appropriate timing and design of riparian-wetland restoration projects (including structural and management changes); and designing monitoring plans. The PFC assessment can serve as a communication tool for bringing diverse groups to consensus, by providing a common vocabulary for identifying the building blocks for the development of desired condition and resulting values.

Application

Practitioners use a checklist for the PFC assessment, which synthesizes qualitative information on hydrology, vegetation, and soil attributes and processes for determining a riparian-wetland area's health. The PFC assessment is intended to be performed by a trained and experienced interdisciplinary team. Quantitative techniques support the PFC checklist and should be used in conjunction with the PFC assessment for individual calibration, where answers are uncertain, or where experience is limited. PFC also serves a starting point for determining and prioritizing the type and location of a quantitative inventory or any necessary monitoring.

Resources

ASSESSING PROPER FUNCTIONING CONDITION FOR FEN AREAS IN THE SIERRA NEVADA AND SOUTHERN CASCADE RANGES

- [PFC User Guide \(PDF\)](#)
- [PFC Webpage \(U.S. Department of Agriculture or USDA Forest Service\)](#)

TECHNICAL REFERENCES

- [PFC Assessment](#)
- [PFC Spatial Standard](#)
- [Riparian PFC assessment to improve watershed management for water quality \(PDF\)](#)

CONTACT

- [Bureau of Land Management \(BLM\)](#)
- [Forest Service](#)
- [National Riparian Service Team](#)

Level 2 Data Management

CRAM

Resources

The California Rapid Assessment Method website provides online data entry forms (eCRAM). EcoAtlas supports online queries and visualization of CRAM results.

ONLINE DATA ENTRY FORMS

- [eCRAM](#)

ONLINE QUERIES AND VISUALIZATION OF CRAM RESULTS

- [California EcoAtlas](#)

CONTACT

- [Email to tech@sfei.org](mailto:tech@sfei.org)

PFC

Resources

Currently there is no public data management system available for PFC data. Data standards are available that include guidance for data storage and database requirements.

PFC DATA STANDARDS

- [PFC Spatial Data Standard \(PDF\)](#)
- [PFC Data Standard Report \(PDF\)](#)
- [Riparian, Wetland and Aquatic Locations Data Standard Report \(PDF\)](#)

CONTACT

- [Email to National Riparian Lead](#)
- [Email to BLM Data Architect](#)

Level 3 – Intensive Site Assessment

This level of monitoring focuses on specific aspects of ecosystem health or overall condition based on quantitative field measures. Common types of Level 3 data for wetlands and streams include the distribution and abundance or density of plant and animal species, concentrations of contaminants or other chemical constituents, hydrological and geomorphic parameters, and primary or secondary productivity. WRAMP requires that Level 3 data be collected using appropriate procedures and methods, such as the standardized survey protocols used by state and federal wildlife agencies to monitor and assess fish and wildlife habitats and populations, plant community composition, noxious weed surveys, and similar survey protocols.

This compendium summarizes available standardized monitoring protocols for WRAMP Level 3 that have been developed for monitoring of water quality, habitat, and wildlife. The Tidal Wetland Monitoring Framework for the Upper San Francisco Estuary¹ combines these different types of Level 3 data to guide integrated monitoring of aquatic resource condition using standardized protocols. It is summarized and presented as a key monitoring guidance document for tidal wetlands and as a template for integrating Level 3 monitoring to address other questions and habitat types.

Tidal Wetlands Monitoring

Estuarine Wetland Monitoring Manual

Purpose

The primary purpose of this manual is to serve as a tool for resource managers, scientists, researchers, agency representatives, students, or anyone with the goal of developing an estuarine wetland monitoring program. It provides a framework to guide the development of Level 3 (site-intensive) monitoring and shows how programs may begin to structure their protocol and method choices to reflect a more standardized approach.

¹ The upper San Francisco Estuary consists of Suisun Bay, Suisun Marsh, and the Sacramento-San Joaquin Delta.

Application

This manual was written to guide the development of coastal, perennial estuarine wetland monitoring programs throughout California by providing SOPs and recommended protocols. It is meant to be a living document that continues to be developed, with supplemental additions of new or modified protocols over time.

Resources

CONTACT

- [The Bay Foundation](#)

Tidal Wetland Monitoring Framework for the Upper San Francisco Estuary

[VOLUME I: MONITORING PLAN GUIDANCE](#)

[VOLUME II: STANDARD OPERATING PROCEDURES](#)

Purpose

Use of this resource will make designing a monitoring program easier for project proponents, and if used widely, the framework should facilitate a clearer understanding of landscape-level effects of tidal wetland restoration.

Application

The Tidal Wetland Monitoring Framework is a tool and resource to guide the development of project-specific monitoring plans to assess the effectiveness of tidal wetland restoration for the benefit of listed fish species in the upper San Francisco Estuary, primarily Chinook Salmon, Delta Smelt, and Longfin Smelt. Recommendations that are relevant to project objectives can be selected for incorporation into a project-specific monitoring plan.

Resources

CONTACT

Fish Restoration Program Monitoring Team, CDFW

- [Email to Stacy Sherman, Program Manager](#)

Water Quality Monitoring

Surface Water Ambient Monitoring Program (SWAMP)

Purpose

The SWAMP of the State Water Resources Control Board maintains monitoring infrastructure (e.g., indicators, methods, and quality assurance/quality control [QA/QC]) necessary to support a robust monitoring program while also fostering data comparability and collaboration with monitoring partners.

Application

The SWAMP provides SOPs for data collection, QA/QC plan templates, and QA/QC protocols. SWAMP quality control and sample handling tables describe Measurement Quality Objectives (MQOs) and specify requirements for sample containers, preservation, and holding times, as well as lab and field corrective actions. They are organized by analytical method or matrix categories and currently include guidelines for measurements of water, sediment, tissue, toxicity, and cyanobacteria/cyanotoxins. The SWAMP Clean Water Team (CWT) has developed guidance for water quality monitoring and data management aimed at citizen monitoring groups and small organizations.

Resources

SAMPLE COLLECTION AND FIELD MEASUREMENTS

- [Collections of Water and Bed Sediment Samples with Associated Field Measurements and Physical Habitat in California. Version 1.1 updated March-2014 \(PDF\)](#)
- [Methods for Conducting Bioassessments in Freshwater Streams and Rivers \(PDF\)](#)

CWT RESOURCES

- [Guidance Compendium for Watershed Monitoring and Assessment](#)
- [Clean Water Team's Tool Box](#)

QUALITY CONTROL

- [SWAMP - Quality Control and Sample Handling Guidelines](#)

CONTACT

- [SWAMP](#)
- [Email to Region 5 SWAMP Coordinator](#)

Biological Surveys and Monitoring

CDFW recommends protocols from various sources to facilitate a consistent and systematic approach for surveying wildlife and inventorying sensitive natural communities. These protocols will help collecting reliable information and maximizing the potential for accurate characterizations of wildlife populations and sensitive natural communities.

CDFW Survey and Monitoring Protocols and Guidelines

Purpose

CDFW recommends protocols from various sources as “tested and reviewed methods for their intended purposes”. These purposes include determining the presence or support for a negative finding for a species or its local status. Presence/absence species protocols have not been developed for all species; therefore, check with your appropriate regulatory agencies for the most current protocols and guidelines available by species for your project location. Other protocols may exist and be available to inform a species status and trends in population abundance and distribution. Be sure to check with the regulatory agencies on the appropriate level of monitoring effort (e.g. frequency and duration of sampling) based on the needs for your project. Projects should be aware of regional plans that their project boundaries reside within that may already have an established monitoring plan in place, for example the Suisun Marsh Habitat Management, Preservation and Restoration’s Monitoring Plan that will guide the individual restoration project’s monitoring.

Application

CDFW lists recommended protocols and guidelines for surveys and monitoring of plants, invertebrates, amphibians, reptiles, birds, and mammals.

Resources

SURVEY AND MONITORING PROTOCOLS AND GUIDELINES

- [Survey and monitoring protocols and guidelines recommended by CDFW](#)

CONTACT

- [Wildlife Branch - Nongame Wildlife Program](#)
- [U.S. Fish and Wildlife Service \(USFWS\) Bay Delta Fish & Wildlife Office](#)
- [USFWS Sacramento Fish & Wildlife Office](#)
- [California Native Plant Society](#)

California Avian Data Center (CADC) Research Tools

Purpose

CADC Field Research Tools are instructions, forms, data tables, and other resources for collecting avian data in the field.

Application

Projects requiring collection of field data on birds.

Resources

RESEARCH TOOLS

- [General Field Tools - Keeping a Journal](#)
- [General Field Tools - Taking Global Positioning System \(GPS\) points](#)
- [Songbird monitoring protocols](#)
- [Shorebird monitoring protocols](#)
- [Rail research tools](#)

CONTACT

- [Email to CADC web team](#)

Salmonid Monitoring Protocol for the San Francisco Bay Area Network

Purpose

This protocol documents the methodology used to monitor salmonids in freshwater streams at Golden Gate National Recreation Area and Point Reyes National Seashore. The protocol provides background information for sampling design, expected analyses, and the SOPs for field work, data management, data analyses, and reporting.

Application

While the primary focus of this protocol is on tracking population trends, reproductive health, body condition, and habitat changes of anadromous salmonids, with an emphasis on Coho Salmon found in the watersheds of the San Francisco Bay Area, in the absence of other protocols, this may still be helpful for fish monitoring in the Delta.

Resources

MONITORING PROTOCOL

- [Salmonid Monitoring Protocol for the San Francisco Bay Area Network Narrative and Appendices and Standard Operating Procedures - Version 4.0](#)

CONTACT

- [National Park Service \(NPS\) San Francisco Bay Area Inventory & Monitoring Network](#)
- [NPS Pacific Coast Science and Learning Center](#)

California Aquatic Invasive Species Management Plan

The California Aquatic Invasive Species Management Plan provides information for prevention, early detection and monitoring, and rapid response and eradication, and long -term control and management for aquatic invasive species threats to the State of California. It focuses on the non-native algae, crabs, clams, fish, plants, and other species that continue to invade California’s creeks, wetlands, rivers, bays, and coastal waters. Contact: [CDFW Invasive Species Program](#).

Habitat Conditions Monitoring

Soil Health –Natural Resources Conservation Service (NRCS)

Purpose

NRCS provides resources and publications offering information on soil health, including Soil Quality Technical Notes.

Application

The NRCS Soil Quality Technical Notes include suggested guidelines for assessing soil quality in the conservation planning process. They are broadly applicable to soil quality monitoring in habitat conservation.

Resources

MONITORING AND ASSESSMENT

- [Guidelines for Soil Quality Assessment in Conservation Planning \(PDF\)](#)
- Other [Soil Health Resources & Publications](#)

CONTACT

- [Soil Health Division Contacts](#)

Vegetation Classification and Mapping Program (VegCAMP) - CDFW

Purpose

VegCAMP provides the vegetation mapping standard for the state, develops and maintains maps, and classifies vegetation and habitats to support conservation and management decisions at the local, regional, and state level. VegCAMP and the Vegetation Program of the California Native Plant Society (CNPS) collaboratively developed and maintain survey protocols, classification and mapping standards, and accuracy assessment processes that comprise the Survey of California Vegetation framework.

Application

VegCAMP provides protocols and QA procedures for the collection of detailed vegetation data, including plant species and percent cover, structure (such as the height and diameter of dominant trees), and environmental information (such as slope, aspect, and soil texture).

Resources

VEGETATION PUBLICATIONS, PROTOCOLS, AND STANDARDS

- [Vegetation Publications, Protocols and Standards](#)

CONTACT

- [Vegetation Classification and Mapping Program](#)

Photo Point Monitoring Handbook – USDA Forest Service

Purpose

This handbook describes quick, effective methods for documenting change in vegetation and soil through repeat photography.

Application

This handbook emphasizes three critical elements: (1) maps to find the sampling location and maps of the photo monitoring layout; (2) documentation of the monitoring system to include purpose, camera and film, weather, season, sampling system, and equipment; and (3) precise replication in the repeat photography.

Resources

PHOTO POINT MONITORING HANDBOOK:

- [Part A Field Procedures \(A1\) \(PDF\)](#)
- [Part A Field Procedures \(A2\) \(PDF\)](#)
- [Part B1 Concepts and Analysis \(PDF\)](#)
- [Appendix A: Forms \(PDF\)](#)

CONTACT

- [Geospatial Technology and Applications Center \(GTAC\)](#)

Human Activities Monitoring

California Recreational Fisheries Survey (CRFS)

Purpose

The CRFS is the method for estimating total marine recreational fin fish catch and effort in California. The CRFS is a coordinated sampling survey designed to gather catch and effort data from anglers in all modes of marine recreational finfish fishing. This program incorporates and updates the comprehensive sampling methodologies of the former Marine Recreational Fisheries Statistics Survey (MRFSS) and the CDFW Ocean Salmon Project.

Application

The CDFW Central Valley Angler Survey follows the CRFS methods. The CRFS methods may be helpful for informing the design of more localized or specialized surveys in the Delta.

Resources

METHODOLOGY

- [Survey Design](#)
- [CRFS Methods Document](#)
- [CRFS Sampler Manual](#)

CONTACT

- [Email to Central Valley Angler Survey](#)

Guidance for Conducting Fish Consumption Surveys

Purpose

The purpose of this document is to provide explicit instructions for selecting a survey approach and designing a survey to obtain consumption rate information. A statistician should also be consulted to provide advice on the specific sampling and statistical analysis considerations for each fish consumption rate assessment project.

Application

Consumption rate information can be used to estimate risks to persons who could consume organisms that might contain bioaccumulative and potentially dangerous levels of toxicants, and to develop consumption advisories and water quality standards to protect human health. Such surveys can also provide demographic information about a population for which advisories are issued, which might assist in the communication of risks and advisory recommendations.

Resources

GUIDANCE DOCUMENT

- [Guidance for Conducting Fish Consumption Surveys \(PDF\)](#)

CONTACT

- [Contact USEPA about technical resources for fish and shellfish consumption](#)

Water Quality Data Management

California Environmental Data Exchange Network (CEDEN)

Purpose

CEDEN is the data management system used by the State Water Resources Control Board for surface water quality in California. Anyone can access CEDEN data online or submit new data through one of the Regional Data Centers (RDCs). Data submitted to CEDEN are made available on EcoAtlas.

Application

CEDEN templates are provided in Microsoft Excel format to help data generators submit their data into the CEDEN system. Each template contains multiple worksheets and sample data submissions. A guidance document accompanies each template and describes each field's data type and provides definitions and business rules.

CEDEN and the associated RDCs strive to ensure data quality and comparability for all data. Data checkers employed by each RDC include audit programs that perform data quality assessments on all submitted data.

The San Francisco Estuary Institute (SFEI) is the RDC for the San Francisco Bay-Delta. Please contact the SFEI Data Center ([email to ds@sfei.org](mailto:ds@sfei.org)) with any questions about submitting your data or using the CEDEN templates.

Resources

CEDEN

- [Submit data](#)

REGIONAL DATA CENTER (RDC)

- [SFEI RDC](#)

CONTACT

- [CEDEN contact information](#)
- [Email to CEDEN Administrator](#)

Biological Data Management

Biogeographic Information and Observation System (BIOS)

Purpose

CDFW's BIOS enables the visualization of the spatial distribution of biological data, the management of those data when necessary, and the sharing of those data with others.

Application

Biological data, such as those generated through the monitoring of plants, invertebrates, fish, amphibians, reptiles, birds, and mammals, should be uploaded into BIOS. To maximize the utility and quality of data and information in BIOS, data must:

- Be submitted in electronic form
- Contain geographic locations of biological observations
- Include attributes that define the observational data (who, what, when)
- Include the minimum metadata.

Resources

DATA ACCESS

- [Biogeographic Information and Observation System \(BIOS\)](#)

DATA MANAGEMENT

- [Metadata Guidelines](#)
- To submit data, please contact the BIOS Coordinator

CONTACT

- [BIOS Contact Information](#)

California Natural Diversity Database (CNDDDB)

Purpose

The CNDDDB is the recommended repository for data related to the observation, occurrence, or distribution of State or federal special-status species or California Native Plant Society (CNPS) listed species.

Application

The CNDDDB accepts data on rare species in several formats. The preferred method of submission depends on the type and amount of data that was collected, the format the data was collected in, and the type of project being carried out. Data of different levels of location accuracy and details are accepted and assigned into 10 accuracy classes. CNDDDB staff can be contacted to help determine the best way to submit data.

The CNDDDB is a complex dataset and there are a few essential facts to understand before working with and creating output from it. CNDDDB staff have summarized important information in a [fact sheet to read prior to working with CNDDDB data](#). Data users may also [email the CNDDDB Coordinator](#) with any questions regarding this dataset.

Resources

CNDDDB

- [California Natural Diversity Database](#)

SUBMIT DATA

- [Submitting Data to the CNDDDB](#)

CNDDDB COORDINATOR

- [Email to CNDDDB Lead Scientist](#)

Environmental Data Initiative (EDI)

Purpose

The EDI is a National Science Foundation (NSF)-funded repository that houses ecological/environmental data. The EDI team prioritizes environmental data from research funded by the NSF Division of Environmental Biology (DEB), but strongly encourages anyone interested in archiving environmental data to contact them. EDI is committed to enable data that is Findable, Accessible, Interoperable, and Reusable (FAIR).

Application

EDI provides support, training, and resources to help archive and publish high-quality data and metadata. Data types typically found in the repository include: observational data, experimental data, data used in a scientific article, synthesis data, and model outputs. There is no limit to the amount of data that can be archived in the EDI repository. However, the EDI team recommends “to not archive anything and everything but consider the current and future value of your data.” Also, large data volumes will require planning and may require some cost sharing between a project and EDI. High metadata standards ensure data usability. Version control and assignment of DOIs (Digital Object Identifiers) facilitate tracking and citation.

The EDI team provides training on how to manage data submissions to the repository or alternatively can manage data submissions by request. Potential data providers are encouraged to obtain a user account for the EDI data portal when archiving many datasets for a project and to control updates and revisions to the submitted data. Potential data providers that plan to archive only a few datasets should use EDI’s data curation team for managing data submissions.

Resources

EDI DATA SUBMISSIONS AND POLICY

- [EDI start page](#)
- [EDI data policy](#)
- [EDI data portal](#)
- [Submit data in the EDI data repository](#)

EDI DATA CURATION SERVICES

- [Email to Data Curation Team](#)

Habitat Data Management

California Fish Passage Assessment Database (PAD)

Purpose

PAD is an ongoing map-based inventory of known and potential barriers to anadromous fish in California, compiled and maintained through a cooperative interagency agreement. The PAD compiles currently available fish passage information from many different sources, allows past and future barrier assessments to be standardized and stored in one place, and enables the analysis of cumulative effects of passage barriers in the context of overall watershed health.

Application

PAD invites feedback regarding the accuracy and updates of the presented fish barrier data.

Resources

DATA ACCESS AND FEEDBACK

- [The Passage Assessment Database \(PAD\)](#)

CONTACT

- [Email to PAD Administrator](#)

Overview Table: Recommended Resources for Standardized Environmental Monitoring and Data Management Plans

Monitored Ecosystem Attributes	Assessment Level	Metrics	Recommended Monitoring Guidance	Data Management Systems
Location, size, and other attributes of aquatic and other natural resources, habitat projects, and watersheds	Level 1 – Landscape scope; remote sensing; GIS derived	Maps, spatial data (geographic location and extent)	Wetland and Riparian Area Monitoring Plan (WRAMP)	EcoAtlas
Overall physical condition and functioning of wetlands and riparian areas	Level 2 – Rapid, field-based, semi-quantitative	Field observations-based scoring	WRAMP	EcoAtlas California Rapid Assessment Method (CRAM)
Tidal wetlands	Level 3 – Intensive, field-based, quantitative	Birds, contaminants, fish community, nutrients, physical processes, primary and secondary producers, vegetation	California Estuarine Wetland Monitoring Manual Interagency Ecological Program Tidal Wetlands Monitoring Project Work Team – Tidal Wetland Monitoring Framework for the Upper San Francisco Estuary, Version 1.0.	Biogeographic Information and Observation System (BIOS) California Data Exchange Network (CEDEN) and Regional Data Centers (RDCs) EcoAtlas

Water Quality	Level 3 – Intensive, field-based, quantitative	Bioassessments, cyanobacteria, cyanotoxins, sediment, tissue, toxicity, water	California Water Boards – Surface Water Ambient Monitoring Program (SWAMP)	CEDEN and RDCs EcoAtlas
Biological Data	Level 3 – Intensive, field-based, quantitative	Amphibians, birds, fish, invasive species, invertebrates, mammals, plants, reptiles	California Department of Fish and Wildlife (CDFW) Survey Protocols California Avian Data Center Research Tools Salmonid Monitoring Protocol for the San Francisco Bay Area Network California Aquatic Invasive Species Management Plan	BIOS California Natural Diversity Database (CNDDDB) EcoAtlas
Habitat	Level 3 – Intensive, field-based, quantitative	Fish barriers, photo monitoring, soil, vegetation	CDFW – Vegetation Classification and Mapping Program (VegCAMP) Protocols U.S. Department of Agriculture (USDA) – Guidelines for Soil Quality Assessment in Conservation Planning (PDF) Photo Point Monitoring Handbook – USDA Forest Service	BIOS EcoAtlas Environmental Data Initiative The Passage Assessment Database (PAD)
Human Activities	Level 3 – Intensive, field-based, quantitative	Fish catch and effort, fish consumption rate	California Recreational Fisheries Survey (CRFS) Guidance for Conducting Fish Consumption Surveys	