

Regional Habitat Monitoring Support: Tools and Services Available to BPA Collaborators

June 28, 2010

Introduction

The Bonneville Power Administration (BPA) is working with regional fish management agencies to implement a tributary-habitat action effectiveness strategy that includes monitoring the status and trends of fish habitat as required by the 2008 FCRPS Biological Opinion (BiOp) in at least one population per major population group. Efforts to standardize this work have been assisted by the Integrated Status and Effectiveness Monitoring Program (ISEMP), a BPA-funded and NOAA-sponsored program, which was tasked with developing regional habitat monitoring approaches through the development and field testing of recommended protocols, data capture, storage, and dissemination tools; and analysis. Given the recent proposed expansion in habitat sampling, some of these tools may be of interest to co-managers, contractors, and others wishing to implement habitat sampling in a consistent manner.

ISEMP has been coordinating and conducting the testing and development of habitat monitoring protocols and tools in several watersheds within the Upper Columbia, Salmon, and John Day subbasins since 2004. In cooperation with numerous agencies and contractors this work has enabled the side-by-side comparisons of numerous commonly employed habitat monitoring approaches and novel techniques across a diversity of Columbia River Basin ecoregions. These efforts recently culminated in the development of a core suite of habitat metrics and associated study design and data collection approach (a protocol). Importantly, this protocol is supported by data capture and data storage tools. The protocol is expected to undergo continued refinement as testing continues; however, we propose to coordinate this evolution such that changes are made globally across all participating projects, are based on data analysis, and occur at a rate that maintains a consistent core data set that can be fully supported by data capture, data storage, and data reduction tools.

The goal of this document and today's conference call is improved collaboration among habitat monitoring proponents in advance of the July BPA proposal deadline to support regional habitat monitoring. If interested, agencies may take advantage of the protocol and associated tools and study design support, with the goal of developing a large-scale regionally coordinated habitat monitoring program, one that is not hampered by gaps in data collection, independent and divergent habitat monitoring methods, disparate or hard-to-retrieve data, or redundant efforts.

The following are brief descriptions of the tools and services which could be provided to habitat monitoring collaborators. These tools and services fall into three categories: (1) sampling design support, (2) field sampling support, and (3) data management support. The extent to which these tools and services are provided will be determined through collaborative agreements between ISEMP, BPA, and cooperating habitat monitoring contractors.

Sampling Design Support

GRTS Sample Design Documentation, Tools, and Application Guidance

A generalized random tessellation stratified (GRTS) survey design was recommended by Crawford and Rumsey (2009) for monitoring habitat status and trend in the Columbia River Basin. GRTS is a probabilistic sampling design that has been shown to be advantageous for generating habitat condition parameters with known statistical characteristics. Implementing a GRTS survey design correctly is critical to producing a final dataset with known statistical characteristics; however, doing so requires the implementation of strict procedures during the site evaluation and selection process. ISEMP has developed a GRTS Site Selection Protocol and Tool (Figure 1) to support field crews with efficiently completing the process while strictly enforcing requirements. Standard data layers (described below) will be available to assist collaborators in developing GRTS sample draws that are consistent across the Columbia River Basin. Additionally, statistical support will be made available to assess the rigor of proposed GRTS sample draws over the three year duration of the current proposal cycle. The desktop tool, technical training, and future enhancements are available for use by collaborating agencies.

Block	SiteName	Ownership	Panel	EvalReason	EvalStatus	Access	EvalDate
801G0-3	CBW05583-009753	Public	Annual Panel	Meets Criteria	Target	Granted	6/4/2010
803G0-3	CBW05583-027737	Public	Permanently Reje	Physically Inaccessi	Target	Not Assigned	6/3/2010
805G0-3	CBW05583-035417	Public	Permanently Reje	Physically Inaccessi	Target	Not Assigned	6/3/2010
806G0-3	CBW05583-035673	Public	Permanently Reje	Physically Inaccessi	Target	Not Assigned	6/3/2010
807G0-3	CBW05583-042521	Public	Not Assigned	Meets Criteria	Target	Granted	6/3/2010
801G>3-8	CBW05583-043865	Public	Permanently Reje	Physically Inaccessi	Target	Not Assigned	6/3/2010
803G>3-8	CBW05583-057881	Public	Annual Panel	Meets Criteria	Target	Not Assigned	6/3/2010
805G>3-8	CBW05583-065625	Public	Permanently Reje	Physically Inaccessi	Target	Not Assigned	6/3/2010
806G>3-8	CBW05583-068441	Public	Rotating Panel	Meets Criteria	Target	Not Assigned	6/3/2010
807G>3-8	CBW05583-070745	Public	Permanently Reje	Physically Inaccessi	Target	Not Assigned	6/3/2010
801G>8-12	CBW05583-075289	Public	Rotating Panel	Meets Criteria	Target	Not Assigned	6/3/2010
803G>8-12	CBW05583-078361	Public	Rotating Panel	Meets Criteria	Target	Not Assigned	6/3/2010
805G>8-12	CBW05583-093273	Public	Permanently Reje	Physically Inaccessi	Target	Not Assigned	6/4/2010
806G>8-12							
807G>8-12							

Figure 1. An example of the Site Evaluation Form from ISEMP's GRTS Site Selection Tool.

Standard GIS Layers to Support Sample Design and Data Reduction

The GRTS-based sampling approach is dependent upon compiling and processing GIS layers consistent with sampling decisions. For example, in order to select sites within a subbasin that have habitat available to steelhead and a gradient of less than 12%, a set of GIS data must be compiled that describes these areas (steelhead extent within a basin, barriers, and streams with a gradient less than 12%). ISEMP can assist cooperators in assimilating, managing, and processing GIS data to support sampling design needs as well as assisting groups that may have GIS support but are unfamiliar with this sampling process.

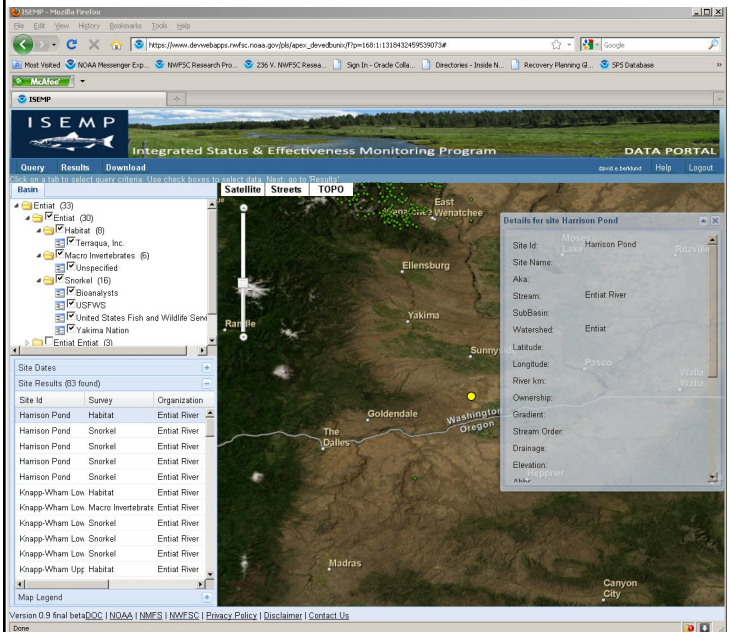
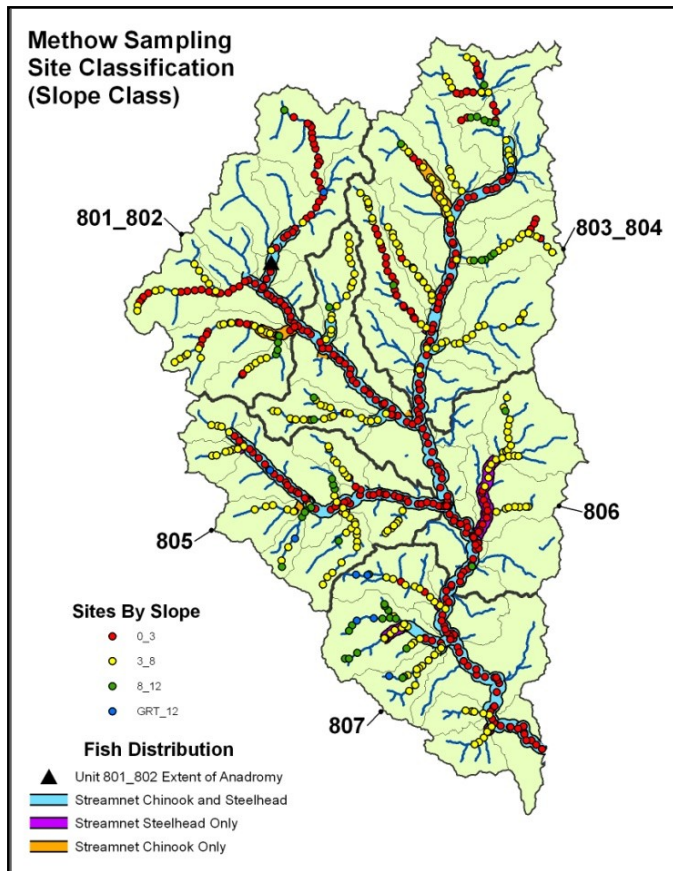


Figure 2. GRTS-based sampling sites in the Methow River subbasin.

GIS Data Management and Geoprocessing

Because regional monitoring programs cover large spatial scales, assimilating and managing spatial datasets in GIS, accounting for the geomorphic context of sampling, and performing watershed or subbasin-scale analyses are important features of these programs. Collaborators will have support assimilating spatial datasets across multiple basins, including managing data and metadata within geodatabases and on web-accessible GIS servers. Also supported is the exploration and development of geospatial models, the use of remote sensing technologies to collect continuous GIS datasets, such as LIDAR and aerial photos, and integrating field-based tabular data within a geospatial context. The results and products from these developmental monitoring programs and assistance in implementing promising technologies will also be provided.

Budget Guidance

ISEMP has developed and administered budgets for numerous private and agency contractors who have conducted habitat monitoring using ISEMP habitat monitoring protocols through funds provided by BPA and is offering to share this experience with collaborating agencies. This direct experience in scoping personnel needs, equipment needs and costs, and other associated costs may be invaluable for BPA contractors who are new to this work. At the same time, the contribution of ISEMP’s experience in fitting the necessary monitoring work within BPA’s contracting requirements would benefit BPA by helping to improve the cost efficiency of this work and ease the contracting process.

Field Sampling Support

Habitat Sampling Protocols

ISEMP has recently conducted a review of fish habitat requirements, interactions of processes that influence fish habitat, the spatial scales for the context of these interactions, and current monitoring programs (ISEMP 2010). This review culminated in the development of a protocol that we believe has the greatest probability of being comparable to other protocols and perhaps most relevant to salmonids. This protocol was designed to be applied across varying spatial contexts depending on the logistical constraints of the sites. In areas where GPS signals can be obtained, along with aerial photos, habitat units within reaches can be superimposed onto aerial photos with a map grade GPS. In situations, where a GPS signal is not obtainable units can be referenced to aerial photos and supplemented with on the ground measurements. Finally, in situations where a GPS signal and aerial photos cannot be obtained a stick and tape method can be employed to delineate the reach into habitat units. These approaches are described in the habitat protocol document (see Appendix 5 of ISEMP 2010). ISEMP will be testing and refining these methods this summer and will provide a revised protocol in the fall of 2010.

Standardized Crew Training: Sampling and Data Capture Tool

Along with ISEMP's experience in implementing habitat monitoring protocols comes several years of development of field crew training. Trained and experienced field crew leaders would be available to provide coordinated, standardized training in application of the protocol. Such a standardized approach would promote crew efficiency and improve standardization across the region.

In addition to agency-specific safety and other training, ISEMP would provide the following training to support cooperating agencies that implement the habitat protocol:

1. Three days of GIS training for cooperators' GIS and sampling design coordinators to explain how to perform GRTS sample draws and allocate sample sites using a priori filters. By the end of this training, cooperators could expect to have sample draws completed, mapped, and listed in field-ready forms.
2. Three days of in-office training on data loggers, data flow management, and QA/QC.
3. Five days of in-field training for field crew leaders and technicians using the ISEMP protocol. Crews would be trained to measure habitat and record data with data loggers.
4. Five days of "as-needed" support throughout the field season for common questions involving data loggers and sampling methodologies.
5. Five days of post-season assistance with data capture and management issues.

As previously described, this protocol is based upon the statistical evaluation of numerous habitat protocols implemented throughout the Columbia River Basin. The protocol will be expected to evolve as standardized data are collected and analyzed from cooperating programs. Evolution of the protocol will be supported through annual meetings of cooperating agencies and changes to the protocol will be implemented globally, thus enabling the necessary modifications to data capture and storage utilities. It is expected that some level of training effort will be required annually to maintain consistency among collaborators and to assist cooperating agencies in employing updated versions of data capture utilities.

QA/QC crews to do repeat sampling across all participating watersheds

Repeated sampling of habitat monitoring sites within the same sampling season has proven to be an important component of GRTS-based, watershed-scale habitat monitoring. Repeat sampling assists with 1) quality assurance/quality control, 2) the assessment of crew variability as a component of variation, and 3) providing improvements to temporal variability recognition (i.e., trend detection). Furthermore, repeat sampling will be important to ISEMP's research goals of testing the performance of the recommended protocol across the Columbia Basin. To achieve these objectives, ISEMP proposes conducting repeat sampling visits for all watersheds in this program at 10 percent of all sampling sites during the same low-flow index period.

Coordinated Habitat and Fish Sampling

Ultimately one of the goals of habitat monitoring is the identification of fish and habitat relationships, the identification of mechanisms through which habitat quality and quantity and natural processes contribute to freshwater productivity. As such, all habitat monitoring programs should capitalize to the extent possible, on existing fish monitoring activities and/or incorporate a fish monitoring component to supplement habitat monitoring information. In short, using fish vital rates (life stage specific survival and growth, and distribution as a function of habitat quality and availability) might constitute the most transferable and applicable suite of habitat characteristics. Methods and guidance are available from the ISEMP website (<http://www.nwfsc.noaa.gov/research/divisions/cbd/mathbio/isemp/documents.cfm>). At the very least, we urge cooperators to identify and summarize fish monitoring that coincides with proposed habitat sampling.



Data Collection Support

Database Schema, Data Dictionary, Meta Data Support and Tool

For a monitoring program at the scale of the Columbia River Basin to be successful, a robust data management system must be in place before initiating data collection. Monitoring habitat in 20 watersheds will generate a massive volume of data. Without properly documented metadata the context that provides meaning to these data would be inaccessible and most likely lost. To insure against that scenario, a system of data processing, storage, analysis, reporting, and distribution to meet the crucial needs of a large-scale monitoring program has been developed (see pages 8 and 9). These needs include: (a) documenting monitoring objectives, study design and intended analysis; (b) summarizing how, when, and where the monitoring data were collected, (c) supporting a range of analytical methods, such as hypothesis testing, time series analysis, structural equation modeling, and GIS support; and (d) adapting to changing requirements in the future.

Collaborating agencies will have the use of a data system that includes a centralized data warehouse and web-based data discovery tool (Status Trend and Effectiveness Monitoring, STEM Databank); data exchange and loading procedures; a database schema that defines data storage format (Aquatic Resources Schema, ARS); metadata tools; data capture, validation, and summary tools (Automated Template Module, ATM); quality control and assurance procedures; and data stewards who support the system.

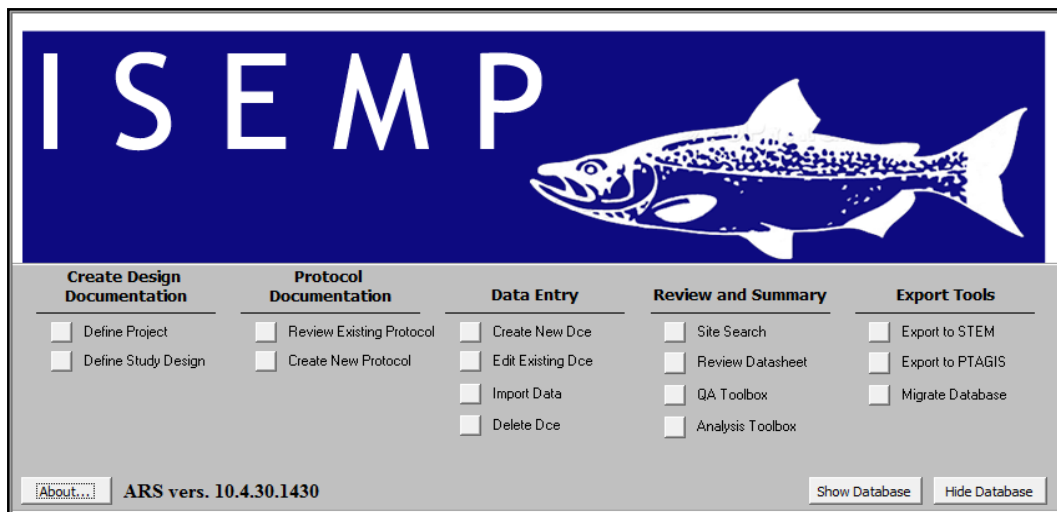
Field Data Capture Tools: Hand Held Loggers or ATMs and Paper Forms

Field crews need applications to support data capture, review, summarization, and reporting. A handheld data-logger program has been developed for the purpose of capturing data in the field. The current software application is transferable to any data logger device that uses Windows 6.1 Mobile and has a screen size of 320x240 (support for other screen sizes will follow). The application includes some on-the-fly quality control by enforcing user established minimum and maximum values for each of the individual data entry fields. Drop down values minimize data entry errors and increase the speed of data entry. The program supports USB or Bluetooth GPS to enable quick documentation of sample coordinates and allows data to be immediately integrated into a GIS program providing instant functionality for mapping.

After sampling and before leaving the site, the habitat application runs a data check to identify any potentially missing data. Once the user finishes the data check process, the data are stored in three locations within the logger to ensure multiple backups exist for the data. Users can define the time span for auto-saving the data based upon their preferences.

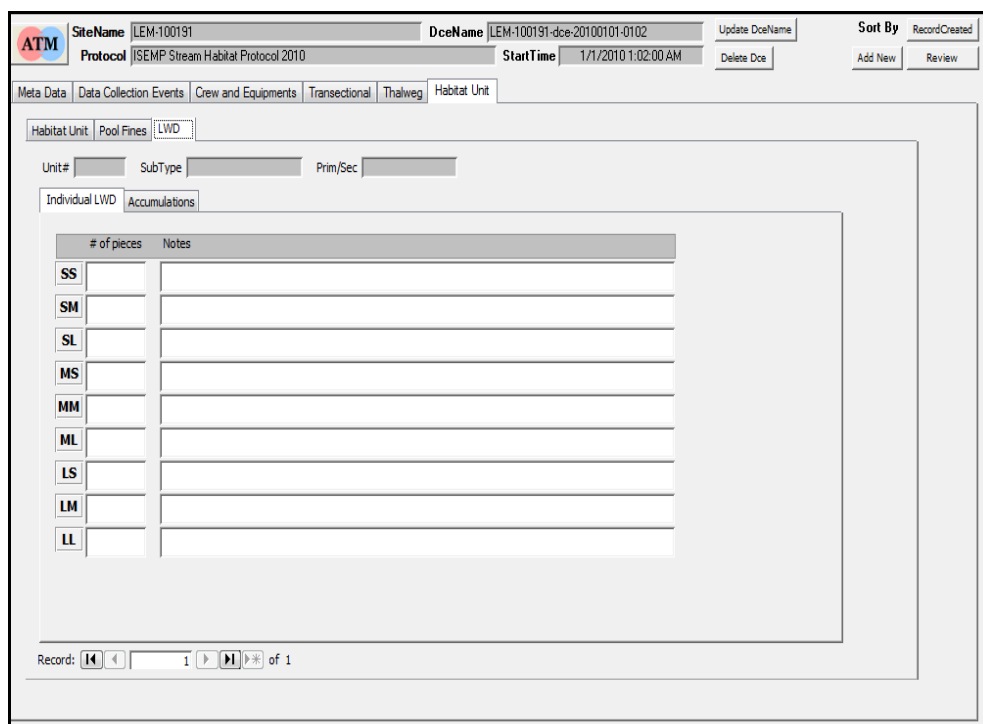
The data are stored in an XML file format, which is then processed through a conversion script. This process makes the data instantly compatible with the ARS Access database. Uploading data is a simple one-step electronic process, which avoids data entry errors that typically occur when transcribing paper data forms into a database. It also bypasses the data entry process, thus saving time and money.

While field-based handheld computers increase efficiency by reducing data entry effort and eliminating transcription errors, desktop applications have also been developed to perform quality assurance reviews, to derive metrics and summarize data, and to generate reports or submit data for archiving. Additionally, the desktop applications provide a backup data entry mechanism in the event that data-loggers fail. The field-based and desktop applications have XML-based mechanisms to synchronize data. Thus transitioning between data entry using handheld data-loggers and paper forms is not accompanied by a synchronization burden.



The Automated Template Module (ATM) supports the full breadth of the data capture workflow. This workflow includes documenting metadata about project and statistical design, entering survey event information and observations, performing quality assurance procedures, deriving metrics, and submitting data for archiving.

Currently, the ATM supports a wide range of data collection protocols including habitat, macro-invertebrate, water quality, snorkeling, screw trap, and PIT tagging protocols. Customized data entry forms can be generated to support the proposed habitat protocol, or any of the other protocols supported by the ATM. These forms would be set within the broader ATM tool and provide a solution that supports the full breadth of the data capture workflow. Data entry forms generated through the ATM are fully integrated within the previously described data system.



Example of an ATM based on the ISEMP Stream Habitat Protocol for 2010

Data Storage and Retrieval Support

The screenshot shows a Mozilla Firefox browser window displaying the homepage of the Integrated Status & Effectiveness Monitoring Program (ISEMP) Data Portal. The browser's address bar shows the URL: https://www.devwebapps.nwfsc.noaa.gov/pls/apex_devedburix/f?p=168:2:1318432459539073. The page features a header with the ISEMP logo and the text "Integrated Status & Effectiveness Monitoring Program DATA PORTAL". A navigation menu on the left includes links for "ISEMP home", "Documents", "Data", "Projects", "GIS Data and Maps", "Tools", and "Contact Us". The main content area is titled "Integrated Status and Effectiveness Monitoring Program Data Portal" and contains the following text:

The Integrated Status and Effectiveness Monitoring Program (ISEMP) was created in 2004 to support PNW-wide aquatic Research, Monitoring and Evaluation programs of listed salmon species and their habitat.

The STEM Databank holds ISEMP collated datasets from these pilot subbasins:

- Wenatchee, WA
- Entiat, WA
- John Day, OR
- South Fork Salmon, ID
- Lemhi, ID

ISEMP is funded through the Bonneville Power Administration (BPA) and Northwest Fisheries Science Center (NOAA-Fisheries).

At the bottom of the page, there are logos for NOAA, the U.S. Department of the Interior Bureau of Reclamation, and the Bonneville Power Administration. The footer includes the text "Version 0.9 final beta" and a list of links: "DOC | NOAA | NMFS | NWFSC | Privacy Policy | Disclaimer | Contact Us".

The homepage for the STEM Databank.

The STEM Databank Document Searching Page.

Documents - Mozilla Firefox
https://www.devwebapps.nwfsc.noaa.gov/pls/apex_devwebbunx/f?p=168:4:1318432459539073

ISEMP Integrated Status & Effectiveness Monitoring Program DATA PORTAL

Document Search

Keywords:

Basin(s): Sub Basin(s):

Survey Type(s): Organization(s):

Document type(s):

Search Documents Clear Cancel

No	Title	Author/Contact Name	Publication Year	Document URL	Document Type	Description
101	A Field Manual for the Electrofishing Protocol	Jeremy Moberg	2009	A Field Manual for the Electrofishing Protocol	Protocol	Electrofi
102	A Field Manual of Scientific Protocols to Jeremy Moberg	2009		A Field Manual of Scientific Protocols	Protocol	
103	A Field Manual of Scientific Protocols to Jeremy Moberg	2009		A Field Manual of Scientific Protocols	Protocol	
104	ISEMP Water Quality Protocol 2008	Jeremy Moberg			Protocol	in develo
105	United States Fish and Wildlife Service	Matt Cooper			Protocol	The obje
106	United States Fish and Wildlife Service	Matt Cooper			Protocol	The obje
107	Washington Department of Fish and Wildlife	Todd Miller			Protocol	The obje
108	Wenatchee Water Quality 2007	Carol Volk			Protocol	in develo
109	ISEMP Water Quality Protocol 2008	Jeremy Moberg			Protocol	in develo

Page 6 of 6 Documents 101 - 109 of 110

Version 0.9 final beta [DOC](#) | [NOAA](#) | [NMFS](#) | [NWESC](#) | [Privacy Policy](#) | [Disclaimer](#) | [Contact Us](#)

The data viewing page in the STEM Databank.

ResultsPage - Mozilla Firefox
https://www.devwebapps.nwfsc.noaa.gov/pls/apex_devwebbunx/f?p=168:6:1318432459539073

ISEMP Integrated Status & Effectiveness Monitoring Program DATA PORTAL

Query Results Download

Click on a file folder to view query results. Next: Select "Download" to get data.

Sampling Events data

No	SURVEY_TYPE	SiteName	StartDateTime	EndDateTime	Season	VisiN	Wetter	Lengt	Gradu	Bankfu	Condu	WaterTe
1	Snorkel	Powerline	19-AUG-08	19-AUG-08	Summer	1	0	0	0	0	0	16
2	Snorkel	Powerline	17-OCT-08	17-OCT-08	Fall	1	0	0	0	0	0	8
3	Snorkel	Powerline	12-MAR-09	12-MAR-09		1	0	0	0	0	0	3
4	Snorkel	Powerline	13-AUG-09	13-AUG-09	Summer	1	0	0	0	0	0	16
5	Snorkel	Harrison Pond	12-MAR-08	12-MAR-08	Winter	1	0	0	0	0	0	8
6	Snorkel	Harrison Pond	20-AUG-08	20-AUG-08	Summer	1	0	0	0	0	0	0
7	Snorkel	Harrison Pond	21-OCT-08	21-OCT-08	Fall	1	0	0	0	0	0	9
8	Snorkel	Harrison Pond	18-MAR-09	18-MAR-09	Winter	1	0	0	0	0	0	6
9	Snorkel	Harrison Pond	18-AUG-09	18-AUG-09	Summer	1	0	0	0	0	0	18
10	Snorkel	Harrison Upper	19-AUG-08	19-AUG-08	Summer	1	0	0	0	0	0	19
11	Snorkel	Harrison Upper	08-OCT-08	08-OCT-08	Fall	1	0	0	0	0	0	8
12	Snorkel	Harrison Upper	10-MAR-09	10-MAR-09	Winter	1	0	0	0	0	0	3
13	Snorkel	Harrison Upper	17-AUG-09	17-AUG-09	Summer	1	0	0	0	0	0	15
14	Snorkel	Knapp-Wham Lower	18-AUG-08	18-AUG-08	Summer	1	0	0	0	0	0	19
15	Snorkel	Knapp-Wham Lower	09-OCT-08	09-OCT-08	Fall	1	0	0	0	0	0	7
16	Snorkel	Knapp-Wham Lower	09-MAR-09	09-MAR-09	Winter	1	0	0	0	0	0	4
17	Snorkel	Knapp-Wham Lower	13-AUG-09	13-AUG-09	Summer	1	0	0	0	0	0	15
18	Snorkel	Knapp-Wham Upper	18-AUG-08	18-AUG-08	Summer	1	0	0	0	0	0	19
19	Snorkel	Knapp-Wham Upper	09-OCT-08	09-OCT-08	Fall	1	0	0	0	0	0	7
20	Snorkel	Knapp-Wham Upper	09-MAR-09	09-MAR-09	Winter	1	0	0	0	0	0	3

Page 1 of 2 Sampling Events 1 - 20 of 3

Version 0.9 final beta [DOC](#) | [NOAA](#) | [NMFS](#) | [NWESC](#) | [Privacy Policy](#) | [Disclaimer](#) | [Contact Us](#)