

Aquatic Data Analysis

Federal Aid Project F-239R-22

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Aquatic Research Data Analyst



Federal Aid in Fish and Wildlife Restoration

Job Progress Report

Colorado Parks & Wildlife

Aquatic Research Section

Fort Collins, Colorado

August 2015

STATE OF COLORADO

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COLORADO DEPARTMENT OF NATURAL RESOURCES

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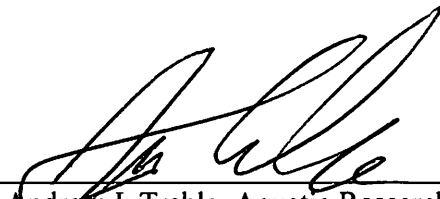
Tracy Davis, Hatchery Technician, Fish Research Hatchery

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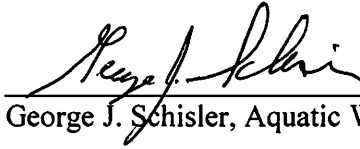
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Date:

8-18-15

The results of the research investigations contained in this report represent work of the authors and may or may not have been implemented as Colorado Parks & Wildlife policy by the Director or the Wildlife Commission.

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State: Colorado

Project No. F-239R-19

Title: Aquatic Data Analysis

Period Covered: July 1, 2014 to June 30, 2015

Study Objective: **To develop analysis of aquatic biological data that accurately describes and/or predicts the status of fish communities and the results of management actions on these communities.**

Study Objectives:

Job 1. Aquatic Data Management System (ADAMAS)

Objective: Development and maintenance of a computer based, statewide aquatic data management system to facilitate the standardized entry of survey data across the state, as well as providing centralized access to information from all sources of aquatic data including CPW stream and lake inventories, Scientific Collection (SCICOLL) reports and CPW creel surveys. Active links between ADAMAS, the Aquatic Animal Health (AAHL) database and CPW Hatcheries database (TRANS6) have been established and will be maintained.

Job 2. Supplemental Database Development

Objective: Development and maintenance of additional computer based, aquatic data management systems to facilitate the management and analysis of data that is not readily incorporated into the ADAMAS database. Examples include: CPW Passive Integrated Transponder (PIT) tag study data, reptile and amphibian encounter data, bulk water temperature data.

Job 3. Data Requests

Objective: To facilitate the review, consolidation, and delivery of aquatic data requests from individuals and agencies both internal and external to CPW. Develop data request and data sharing documents, serve as the main contact for internal/external data requests and coordinate the review of each external request with the review committee. Consolidate data requests, obtain signed agreements, and maintain records of all requests and outgoing data.

Job 4. Technical Assistance and Data Mining

Objective: To provide technical and statistical assistance to researchers, field biologists, and staff on a variety of aquatic data analysis topics, as well as attempting to answer questions pertinent to the management of aquatic resources in Colorado by analyzing current and historical data. Topics include creel survey, inventory survey, management categorization, fishery trends, spatial data analysis, hardware and software review and upgrades, application and supplemental database development, as well as other computer related data analysis needs.

2014-15 Results:

Job 1. Aquatic Data Management System (ADAMAS)

A. ADAMAS Database Management and Maintenance

The effort to collect and enter both current and historic fisheries data from field survey sheets stored at various CPW offices continues. At the beginning of this reporting period, the database held 36,217 surveys at 13,365 locations across the state, with 2,324,389 fish sample records, representing 6,203,169,782 fish.

During the reporting period (July 1st, 2014, to June 30th, 2015), we've added 7,741 surveys (from 2,306 new or 13,365 existing sampling locations), with 697,569 sampling records representing 1.53 million fish. Of those, 1,648 surveys were performed by CPW biologists, with another 2,214 surveys from SCICOLL reports. A further 3,879 historic surveys were added by the aquatic database team. A summary of the surveys added to the database over the course of this reporting period is provided in Table 1.

Table 1. Source and content of surveys added to the database during this reporting period.

Project	# Surveys	# Samples	# Fish
Aquatic Database	3,879	201,032	626,996
Scientific Collections Permit	2,214	272,349	541,001
Northeast Region Fisheries Management	974	115,992	174,543
Southwest Region Fisheries Management	191	21,088	29,847
Northwest Region Fisheries Management	189	28,940	33,969
Species Conservation	172	44,712	89,389
Southeast Region Fisheries Management	105	12,308	26,722
Aquatic Research	17	1,148	6,845
Total For 2014-15	7,741	697,569	1,529,312

We continue to bring sampling surveys into the system from a variety of sources. Initially, the database was comprised of records from the (former) Colorado Division of Wildlife's Stream

and Lake Databank (the predecessor to ADAMAS) compiled by David Weber. In the 90's, a database of historical sampling, compiled by Dr. Kevin Bestgen, to support the South Platte and Arkansas Basins' Eastern Plains Native Fishes reports was incorporated. Since 1993 there have been annual reports of surveys submitted by CPW biologists and SCICOLL permit holders. The original ADAMAS database was designed around basic parameters collected in the field with enough flexibility to support the variety of inventory sampling protocols used by aquatic biologists, researchers and consultants across the state. We continue to standardize field data reporting formats based on that design, allowing for expansion to accommodate new methods and projects.

We continue with the effort we began several years ago to systematically review area office hardcopy files, scanning field data sheets to PDF for entry by database staff. As surveys are processed, sampling information is verified and compared to data from previously entered surveys. From time to time, historic survey reports with more detail and individual fish data are found to replace previously recorded, summary information.

The following table shows the total database holdings, including the number of surveys, fish samples, and fish counts, summarized by reporting cycle (July 1st – June 30th).

Table 2. Current data holdings of CPW aquatic database

Range	# Surveys	# NewSites	# Samples	# Fish
Pre-2003	12,681	6,997	346,893	1,621,243
2003-2004	1,309	294	24,339	42,887
2004-2005	1,615	576	92,148	116,740
2005-2006	1,999	646	168,465	316,816
2006-2007	1,150	169	43,040	90,333
2007-2008	1,298	454	144,726	215,713
2008-2009	2,576	777	267,700	634,367
2009-2010	2,744	455	360,543	738,467
2010-2011	1,518	392	214,125	524,643
2011-2012	1,143	463	138,292	223,358
2012-2013	2,013	945	130,804	343,591
2013-2014	6,171	1,197	393,314	1,335,011
2014-2015	7,741	2,306	697,569	1,529,312
	43,958	15,671	3,021,958	7,732,481

Several related efforts affecting the ADAMAS database and CPW aquatic data as a whole have taken place during this reporting period:

- i. Updates to our aquatic data application, ADAMAS, were installed on the main database server to address bugs and enhance capabilities. This system allows biologists across the

state to directly link to the SQL database, query the database, upload or directly enter data and analyze individual surveys.

- ii. Tables were added and/or modified in the main database to house data concerning water reclamations, creel summaries, PIT tagging data and Survey purpose.
- iii. A 32-bit computer was designated to house the newly consolidated Creel survey data and run the C-SAP program for creel data analysis. If funding and a qualified vendor can be located, it is hoped that a similar customized and inter-connected application can be developed and merged with the rest of the aquatic data module to allow for the analysis and integration of fisheries creel data.
- iv. Investigations into mobile data gathering applications was re-started during this reporting period, this time focusing on applications that can be run on ruggedized tablets and other handheld devices. This appears to be a relatively new but competitive marketplace, and CPW is working with several companies to develop a functional fish data collection application that can be field tested during 2015-2016.

B. The ADAMAS Application

Standardization of inventory sampling data entry, analysis and reporting continues to be the primary target of an ADAMAS application within the AQDB. As we have described in previous reports, the applications' designs and implementation were set up to take place at a rate of one application per year, with the Hatcheries production application to be implemented first, followed by ADAMAS, a network-accessible version of C-SAP (creel survey analysis) and then a network-accessible application for the AAHL (disease inspections and certifications).

At the time of this report, the ADAMAS and TRANS6 (Hatcheries) applications have been utilized for about two years. An upgrade to both ADAMAS and Trans6 applications, as well as a redesigned AAHL module was completed and installed over the time frame of this report and work continues to deal with any remaining bugs that are discovered. Funding and a capable vendor have not yet been identified to complete the C-SAP portion of this plan.

C. Ancillary Front-Ends

Development of need-specific front-ends for other CPW users to access the data within the database, while controlling what data they have access to or how it is summarized, is another continuing aspect of this project. Currently an ADAMAS-Links (MS Access) database has been developed for biologists to summarize and analyze data from multiple surveys and continues to be improved and updated. A separate Access front end that allows the CPW water quality coordinator to identify species assemblages for specific water segments is also being maintained. In addition, level one data (stream/lake/station name, location, sampling dates) and some basic survey information are accessible internally through a web-based GIS application (the CPW

Watercode and Station locator). The general public may also access fisheries data through the Colorado Fishing Atlas web-GIS portal.

D. Data Requests

Requests for CPW aquatic data continue to be filled in a timely manner, with priority given to support CPW research and management needs. Federal, state and local government agencies, consultants, contractors and educational researchers are accommodated as expeditiously as possible. Requests from the general public are generally referred to Aquatic Area biologists and the Colorado Fishing Atlas. A total of 60 data requests were received during the timeframe of this report, which represents a 25% increase from the number received during the 2013-2014 reporting period. A summary of data requests received during this reporting period, excluding all requests originating within CPW, is provided in Table 3.

Table 3. Source of external data requests for CPW aquatic data

Organization Type	# Requests
Private Consultant	18
Federal Agency	12
Academic Institution	10
NGO	6
Water Company	4
State Agency - External to CPW	3
Other	3
Watershed Council	1
Municipality	1
General Public	1
County	1
Total Requests	60

A centralized process for review of requests by CPW’s biologists prior to release of data has been formally adopted. A formal request for data is made via email to the data analyst with a completed CPW Aquatic Data Request Form (Appendix A). The form allows the requestor to declare their intended use for the data, define the specific waters or geographic area of interest, and identify the final user of this data (i.e. their client). The second page allows the requestor to further define the resolution (both temporal and spatial) required and the justification for so.

The request, and often the data requested, is distributed to the Aquatic Data Request Group via email for review and comment. The members include the Aquatic Research Leader, the regional Senior Aquatic Biologists, the Water Unit Manager, the regional Senior Wildlife Species Conservation biologists, the regional Aquatic or Water Quality Wildlife Species Conservation biologists, the Aquatic Toxicologist, the Aquatic GIS Specialist and the Aquatic Database Manager. The members of this group are aware of aquatic issues statewide and are all in contact

with Aquatic Area biologists responsible for the management of waters in the requestor's area of interest. Discussions take place among the members via email to determine how the request is to be filled. Once everyone is in agreement, or has deferred decision-making on the request to other members of the group, a data sharing agreement is sent to the requestor for signature (See Appendix B). This form simply states that the data is provisional, will not be passed to a third party and that raw data, when distributed, will not be displayed or published in its raw form. Once this signed agreement is on file, the request is filled electronically via email. The requested deliverable, the request form, signed agreements and a copy of the email discussion are archived for future reference.

Job 2. Technical Assistance and Data Mining

The primary activities relating to this reporting period were:

- 1) Serving as the coordinator for the development of the various database applications. Acting as the primary contact between CPW and the software vendor, compiling a list of bugs from users and monitoring the results of new beta versions.
- 2) Development of data entry templates and applications compatible with updated versions of the ADAMAS application, for use by CPW biologists in the field and Scientific Collector Permit reports.
- 3) Training new biologists and researchers in the use of the ADAMAS application and serving as the primary contact for any questions regarding data collection, entry and analysis.
- 4) Microsoft Access database support for other CPW units and staff. Development of supplementary databases outside of the primary ADAMAS system.
- 5) Exploring the data within the database and looking for trends in the data. Assisting researchers explore various questions relating to ongoing research. Developing new research questions and identifying informational gaps in the data, based on results of data exploration.

Specific improvements and topics of investigation undertaken during this reporting period include:

- i. Added a Tableau visual analytical software license to the analytical toolbox. Tableau links directly to SQL or Access databases (in real time) and easily allows for the manipulation of data, including spatial datasets, in a very adaptable and useful visual output.
- ii. Started to look at factors that influence the rate of displacement of cutthroat trout by invasive brook trout in Colorado (ongoing).
- iii. Began collaboration with Colorado State University (CSU) Stats Department, using statistical re-sampling methods to optimize sampling effort on reservoirs in Colorado.
- iv. Began collaboration with CSU assessing factors that may influence the magnitude of climate change on high elevation lakes in Colorado (ongoing).
- v. Collaborated on identifying the effects of the 2012 floods along the CO Front Range on the fish community of St. Vrain, Boulder Creek, Big Thompson, and Cache La Poudre watersheds.
- vi. Initiated investigations into the effects of forest fire and pine beetle deforestation on nearby fish populations (ongoing).
- vii. Began development of mobile data entry applications to increase efficiency and accuracy in the field.

Appendix A: CPW Data Request Form



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Request for Aquatic Data

1. (a) Name (s) of persons requesting data: _____

1. (b) Organization/Company/Agency Name (s): _____

1. (c) Organization/Company Agency Contact Information:

PHONE: _____ FAX: _____ email: _____
(Email address is where electronic data files would be sent)

1. (d) Ultimate person/organization asking for the data (i.e. if a consultant is making this request, who is the client?):

2. (a) We are requesting data for the following water bodies/geographic area:

(Note that CPW does not typically distribute point-sample locations or generate GIS maps)

2. (b) Describe the data you are requesting (fish species distributions? Water quality parameters?):

3. Please describe your intended use for this data:

4. You are advised of the following regarding the requested data:

- (a) the data may be exempt from the Colorado Open Records Act, in which case, CPW may deny your request (refer to CORA for exemptions)
- (b) the data may be in provisional status (i.e., error check still in progress)
- (c) raw data values should not be changed. If you have original or copies of data sheets or previous exports with differences in the data you receive, please call or email for possible corrections.
- (d) Do not redistribute this data to parties not listed above. Other parties must submit a formal request to CPW to insure that they receive the most updated version of the data available.

5. Resolution:

In order to speed up the approval and data distribution process, please further define you data needs. While we will strive to give you the data you have requested in a timely manner, keep in mind that the lower the resolution of your data request, the less scrutiny (and thus time) required by the data request



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review committee, and also the more likely that your request will be approved. Note that requests for raw data will need to demonstrate this need to the committee before approval will be granted.

- (a) What level of fish data are you requesting (Species Resolution):
- i. Species Occurrence (For all species? For specific species?)
 - ii. Species numbers, size ranges, population estimates, and biomass
 - iii. Data on individual fish collections
 - iv. Creel Survey Data?
 - v. Fish Stocking Data
- (b) At what scale do you want this data summarized (Spatial Resolution):
- i. (i) Basin (6 digit HUC)
 - ii. Sub basin (8 Digit HUC)
 - iii. Watershed (10 Digit HUC)
 - iv. Sub-Watershed (12 digit HUC)
 - v. Catchment
 - vi. Individual water body/Survey Sample points
- (c) How far back do you want to go (Temporal Resolution):
- i. Only the most recent surveys
 - ii. Back to a specific year? Please specify: _____
 - iii. All data in the CPW Aquatics Database

Additional Explanation or requirements:

Please provide as much information as possible and return to:

Andrew J. Treble

Aquatic Research Data Analyst

Aquatic Research Section, Research, Policy & Planning Branch



COLORADO

Parks and Wildlife

Department of Natural Resources

P: (970) 472-4372 | F: (970) 472-4458/4457 | C: (517) 420-4588

317 West Prospect, Fort Collins, CO 80526

AndrewTreble@state.co.us | www.cpw.state.co.us

Appendix B: CPW Electronic Data Sharing Agreement



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317 W. Prospect Rd, Fort Collins, CO 80526
 970-472-4300 • 970-472-4457
 wildlife.state.co.us • parks.state.co.us

Non-disclosure Agreement for the Use of Colorado Parks and Wildlife Electronic Information

- 1) Colorado Parks and Wildlife (CPW) will provide information on aquatic species, statewide, as requested by XXXXXXX of XXXX for the purposes of providing a baseline for the National Rivers and Stream Assessment Survey. These data will be used solely by XXXXXXX for the purpose of this project.
- 2) CPW, for management and conservation reasons, considers this information confidential and sensitive due to the elements' vulnerability to intentional and unintentional disturbance, interpretation, and due to agreements made with, and statutory requirements for, the protection of individual landowners' privacy.
- 3) We, the undersigned, acknowledge that the information noted above is considered sensitive and confidential, and agree to the following stipulations:

For Raw Data

- i. Raw data will only be accessible to XXXXXXXXX and to no other individual or entity, nor will it be published or made available for public viewing in its raw state. It may be used in analysis and summaries that are then published or reported to clients without issue.
- ii. The information may not be transcribed or reproduced in any manner, unless authorized in writing by the CPW representative and signatory identified below. Locations may be displayed spatially if necessary to their stated purpose, but only in a manner and at a scale where specific locations of individual points cannot be derived.
- iii. The information will be used for the requested purpose described above and for no other purpose. The information will be destroyed upon completion of the project and may not be kept for future use. Any future requirements for the data will involve a new data request to ensure the most up-to-date data is used.
- iv. Requests involving biological interpretation or use of the information beyond the stated purposes will be referred to CPW aquatic biologists.
- v. CPW does approve the passing of summary reports, based on this data, to the reported end-user (XXXXXXXXXX) at the end of this project.

For Summarized Data

- i. The information will be used for the requested purpose described above and for no other purpose.
- ii. The information will be destroyed upon completion of the project and may not be kept for future use. Any future requirements for the data will involve a new data request to ensure the most up-to-date data is used.
- iii. Requests involving biological interpretation or use of the information beyond the state purposes will be referred to CPW.

Signed by:

 Colorado Parks & Wildlife (signature)

 Data Requested By (signature)

 (Please Print)

 (Please Print)

 Date

 Date

STATE OF COLORADO
 John W. Hickenlooper, Governor • Mike King, Executive Director, Department of Natural Resources
 Bob D. Broscheid, Director, Colorado Parks and Wildlife
 Parks and Wildlife Commission: Robert W. Bray • Chris Castilan, Secretary • Jeanne Home
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 Mark Smith, Vice-Chair • James Vigil • Dean Wingfield • Michelle Zimmerman
 Ex Officio Members: Mike King and John Salazar



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970-472-4300 • 970-472-4457
wildlife.state.co.us • parks.state.co.us

Colorado Parks and Wildlife Data Request Disclaimer

Colorado Parks and Wildlife (“CPW”) collects aquatic data from both internal sources and a variety of external governmental and non-governmental agencies. CPW provides this data, upon request, solely as a public service. As a significant proportion of this data comes from an outside agency, over which CPW lacks the ability to verify the protocols and data collection procedures, CPW makes no warranty, representation, or guarantee as to the content, accuracy or completeness of any of the data provided. CPW makes this data available on an “as is” basis and explicitly disclaims any representations and warranties, including, without limitation, the implied warranties of merchantability and fitness for a particular purpose. The CPW assumes no liability and the user assumes all liability for: 1. any errors, omissions, or inaccuracies in the data provided, regardless how it was caused; or, 2. any decision made or action taken or not taken by anyone using or relying upon data provided.

Use of Data

CPW may require a user of this data to terminate any and all display, distribution or other use of any or all of the data for any reason including, without limitation, violation of these Terms of Use.

Signed by:

Name (signature)

Name (Please Print)

Date

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