Annual Report 1993

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Columbia River Coordinated Information System

FY 1993 Annual Report
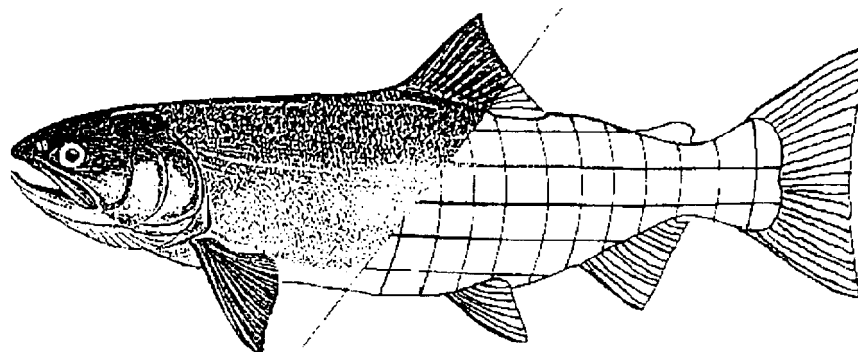
U.S. Department of Energy
Bonneville Power Administration
Division of Fish and Wildlife

Columbia River Inter-Tribal Fish Commission
Idaho Department of Fish and Game
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Northwest Power Planning Council
Oregon Department of Fish and Wildlife
Pacific States Marine Fisheries Commission
Shoshone-Bannock Tribes
U.S. Fish and Wildlife Service
Washington Department of Fisheries
Washington Department of Wildlife

FY 1993 Annual Report:

Period Covered:
October 1, 1992 - September 3 1, 1993

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NOVEMBER 1993

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EXECUTIVE SUMMARY

The purpose of this report is to document and provide an overview of work efforts completed in meeting contract requirements for the Columbia River Basin Coordinated Information System (CIS), for the period of October 1, 1992 through September 30, 1993 (FY93).

Participants in the CIS Project have made significant progress in FY93 in meeting the goal to "develop and provide an efficient system for obtaining and exchanging information needed to plan, monitor, and evaluate anadromous fish protection, mitigation, and enhancement activities." A significant amount of the data and information needed to meet that goal was compiled, standardized and computerized in FY93. A distributable user-friendly system for providing the data and information to users was developed and tested.

Participants in the CIS project formed a well organized and coordinated team in FY93, which will carry the project forward in years to come. This team is committed to providing users the most timely and accurate data and information available, data that have been collected, compiled, and approved by the fisheries agencies and tribes.

Products and services completed and available from FY93 efforts include:

Reports
CIS FY 1993 Annual Report
CIS FY 1993 Services and Features Report
CIS Distributed System Users Guide
CIS Distributed System Specifications Report
FY94 Statement of Work and Budget

Databases
CIS Distributed System
- Stock Summary Report Data
- Escapement Database
- Dam Count Database (Summary)
- Anadromous Hatchery Database
- Data Catalog (Data Set Directory)
- Literature Catalog

Services
Data/Information Requests
Bulletin Board (CISNET)
CIS Library

Work efforts in FY94 will focus on updating all databases, enhancing the hatchery and natural production databases, potential expansion of the CIS to coastal drainages and California, continued coordination and communication with other projects, work groups and organizations, and meeting user defined data and information requests. The CIS project will become much more visible and useful in FY94 now that the infrastructure is in place and products are available.

Adequate funding, support and patience will pay off for a region desperately needing a "coordinated" information system. Agencies and tribes have committed highly qualified and dedicated staff to the CIS project. The success experienced in FY93 will continue, to the benefit of the region and the fish.

INTRODUCTION

The purposes of this report are to: 1) describe the project to date; 2) document the work and accomplishments of the Coordinated Information System (CIS) project for Fiscal Year 1993 (FY93), which covers the period from October 1, 1992 to September 3 1, 1993; and 3) to provide a glimpse of future project direction. Further detail regarding any of the information provided in this report can be obtained through additional CIS documents or by contacting any of the CIS staff (Appendix A).

Project History in Brief

The concept of a CIS was initiated in the mid-1980's by the Northwest Power Planning Council (Council) as an approach to meeting the growing needs for regionally standardized anadromous fish information. The CIS was further defined in Section 7.6 of the Council Strategy for Salmon: Volume II (NPPC 1992). In response to this direction, the CIS project was initially set up to proceed in phases. A description of these phases is provided in Table 1.

In FY93 the decision was made by the CIS Steering Committee to refer to fiscal years (such as FY93, FY94 etc.) for work periods instead of the Phase (1,2, etc.) approach. This was done primarily to alleviate confusion over how long it should take to complete each phase of the project. In reference to project planning or progress, the terminology of *development phase* or *implementation phase* may still be used in reference to the progress of a particular component of the project.

Table 1. A summary of Coordinated Information System development schedule.

Project Phase	Phase Description	Status and Time Period
1	Overall project design; assembled background information; developed approach	Completed
2	Detailed assessment of information needs; assembling and updating basic anadromous population information; identified information gaps; multi-year plan for testing and implementation	Completed
3 (FY93)	Formally structured CIS as a regional and ongoing project; database development with focus on summary data; system development; prototyping; distribution of initial system; coordination and education	1/1/93 - 9/31/93 Completed
4 (FY94)	Continued database development including update; continued system development; full implementation of the CIS system; long-term project plan established and implemented	10/1/93 - 9/31/94 In Progress
Maintenance (Out-Years)	Update and expand databases as appropriate; add features and services in response to user needs	Planned / Ongoing

Project Goal and Primary Objectives

The work completed and planned for the CIS project is based primarily on the goal and primary objectives as outlined during FY92 (Roger et al. 1992).

The goal of the CIS is:

> To develop and provide an efficient system for obtaining and exchanging information needed to plan, monitor, and evaluate anadromous fish protection, mitigation, and enhancement activities in the Columbia River Basin.

The primary objectives for this project are to:

A.   Develop and provide an Anadromous Fish Information System (AFIS), to store and disseminate data contained in the Natural Production, Hatchery Production, Habitat, and Multi-Stock components and to further provide summarized anadromous stock data, and monitoring and evaluation data, in standardized formats;

B.   Develop and provide an Anadromous Fish Reference System (AFRS), to organize, store, and disseminate anadromous **salmonid** reference information, and build the capability to:

     1.   Facilitate access to and respond to user requests for references to the basin grey literature and other less accessible sources of **salmonid** information;

     2.   Facilitate access to individuals and organizations who are direct sources of anadromous **salmonid** data and datasets;

     3.   Provide access to historic and current information on Council program activities;

     4.   Provide access to Columbia River system models and other technical tools used in system management;

C.   Integrate and provide AFIS and AFRS components in a single electronic system (Distributed System) that provides the described information and services via a common user interface and menu structure.

D.   Develop a network of data producers and suppliers who use a common set of information organizing and information sharing protocols and principles.

E.   Develop and provide an ongoing program for initial training, current awareness of data needs, providing services to users, and troubleshooting of the system;

The CIS goal and objectives were developed to meet the intent of the Northwest Power Planning Council in defining the CIS project under Section 7.6 of its Strategy for Salmon document.

Purpose and Objectives of FY93 Work

Work completed in FY93 followed the CIS goal statement and primary objectives, as described in the preceding section. FY93 (originally termed "Phase 3") was devoted to development, testing, bringing data into standardized database formats, and structuring the project for implementation and maintenance/enhancement. A great deal of time was also spent discussing and coordinating the work of the CIS project with other projects, work groups and organizations.

The full FY93 contract was not initiated until January 1, 1993. Most of the work described in this report occurred between January 1 and September 31, 1993. An abbreviated task list and the project progress on completing each of the tasks is provided in Appendix B.

Organization and Project Participants in FY93

The CIS project was restructured in FY93 as the system became operational. The Steering Committee selected a Project Manager in February, 1993 and agreed to locate the project at the Pacific States Marine Fisheries Commission (PSMFC). The CIS project manager provides regional project management and coordination, CIS Steering Committee coordination and assistance, and an administrative function in coordination with Bonneville Power Administration. In addition, some of the CIS Steering Committee members changed during the year, including the addition of the National Marine Fisheries Service as a participating organization (Appendix A).

CIS Steering Committee (Organizations Represented in FY93)
        Bonneville Power Administration
        Columbia River Inter-Tribal Fish Commission
        Idaho Department of Fish and Game
        National Marine Fisheries Service (Since 8/93)
        Northwest Power Planning Council
        Oregon Department of Fish and Wildlife
        Pacific States Marine Fisheries Commission
        Shoshone-Bannock Tribes
        U.S. Fish and Wildlife Service
        Washington Department of Fisheries
        Washington Department of Wildlife

A major focus of the CIS project in the past year was system development, programming, and testing. Based on this component of the project, a "Programming Team" was formed from highly qualified staff located at the Idaho Department of Fish and Game (IDFG) and Washington Department of Fisheries (WDF). IDFG was designated as the lead for system development and programming for the CIS.

The administrative structure of the CIS project is following the agreed upon plan described in an FY92 report (Allen et al. 1992). State and Regional Data Manager positions and roles are being, or have been, formally defined and in some cases initiated. The long-term CIS administrative structure will be fully implemented in FY94 and will be more fully described in a Project Plan being developed.
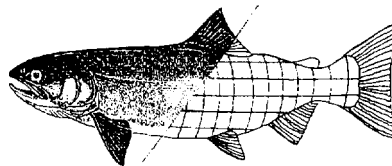
ACCOMPLISHMENTS

Systems Development

The major software development effort for FY93 was the construction of a portable PC-based system to retrieve and report the data contained in both the Anadromous Fish Information System (AFIS) and Anadromous Fish Reference System (AFRS) components of the CIS Distributed System. At IDFG, a system called *the Idaho FrontEnd System* has been used for several years to provide a simple user interface to complex databases. The Programming Team, in consultation with the Steering Committee, chose to adopt the FrontEnd System as the vehicle for the CIS Distributed System (Reece 1993). This choice reduced the amount of software development that was needed to get the system up and running, though a significant amount of customizing was required to meet specific CIS needs. Once data structures were developed for the various database components (see below), previously collected data were loaded, routines for generating pre-defined screen views and paper reports were added, and the CIS Distributed System was ready for user testing.

During FY93 we released three major prototype versions of this system for review (June 12; August 4; September 16). Copies of the system, along with all data that had been loaded to date, were distributed to regional users by members of the Steering Committee. A form assisting users in documenting system problems, data errors, or suggestions for improvement accompanied the system to help organize user feedback. Comments, suggestions, and "bug reports" were compiled by the Programming Team, and the disposition of these responses was documented (Reece 1993b).

After addressing the major improvements that were identified during prototype testing, we prepared to generate the first "production" release of the CIS Distributed System and planned more widespread regional distribution for late October, 1993. At that point, the system was able to produce the major standard Stock Summary Report or defined Monitoring and Evaluation tables on-screen or in paper form upon request.

Database Development

Anadromous Fish Information System

One way to categorize the information we are compiling is to use the terms "data" and "text". By "data" we refer to information normally stored in numerical or coded format; "text" refers to readable phrases, such as footnotes or other reference material. The Anadromous Fish

Information System (AFIS) is a collection of *data* linked to a companion system of *text* called the Anadromous Fish Reference System (AFRS).

Data from several sources were compiled, re-structured, and loaded into the AFIS. The CIS Programming Team developed the data structures, coordinated the collection of data from each of the three states, and loaded the data into the CIS electronic databases. The largest part of this effort was the transfer of the data listed in tables in the CIS Stock Summary Reports (Hymer, et a. 1992; Kiefer, et al. 1992; Olsen et al. 1992) into databases specifically structured for the AFIS. In addition to these data, region-wide escapement data , dam count data, smolt passage data, and in-river commercial harvest data were also compiled and loaded into the system.

Table 2. A summary of the databases **contained in,** or *prepared for,* the Anadromous Fish Information System, FY 1993.

SUMMARY REPORTS	NATURAL PRODUCTION	HATCHERY PRODUCTION	HABITAT	SYSTEM
Stock Summary Reports	**Redd counts**	*IHOT Goals*	**Subbasin Planning**	**Catch**
Monitoring Report	*Other Escapement*	*Hatchery Descriptions*	*USFS Habitat Conditions*	**Smolt Indices**
IHOT Hatchery Audit		*Rearing*	*Water Quantity*	**Dam Counts**
		Disease	*Water Quality*	*Tag Summaries*
		Release	*NED link*	
		Returns		

Anadromous Fish Reference System

The Anadromous Fish Reference System databases perform several functions. Documentation for data in the AFIS is included in the Literature Catalog database, and pointers to additional information about other data items and **datasets** are provided in the Data Catalog database. The CIS is the only fishery information system we know of designed to provide these types of documentation for numeric databases. The Literature Catalog will also provide a searchable

list of citations for the fisheries grey literature in the Columbia Basin. This service is not presently available in other systems.

Literature Catalog

The development of the Literature Catalog involved 1) compiling a single master electronic copy of the citations contained in the Stock Summary Reports, 2) transforming the word processor file into an electronic database format, 3) obtaining physical copies of the documents, and 4) developing full catalog entries for a subset of these documents.

The first two steps were complicated because of the sheer breadth of the Stock Summary Reports. Each stock in each subbasin within each state had the potential for a discrete list of references. In addition, the lists of references provided by the states changed over the course of the project as references were added or verified. As the lists were combined electronically they were checked for duplicate citations, differing and inconsistent formats, and incomplete citations which could not be verified.

Creating the Literature Catalog database required developing the record and database structures, creating the link functions between the AFIS and AFRS, and developing the classification and data entry conventions. These steps required assistance from the CIS programming team. Details of these tasks are discussed in the CIS System Report (Reece 1993).

Obtaining actual copies of the cited documents was necessary to insure accuracy of the citations and to allow full cataloging. The number and degree of inconsistencies in the citation lists required the documents to be physically in hand for accurate cataloging. Inconsistencies ranged from simple typographic errors in a publication date or project number to differing forms of an author's name. Some citations did not include all of the standard elements of a scientific bibliographic citation. Resolving these inconsistencies required a great deal of time.

Agencies were provided lists of needed documents at intervals. Initial state lists included all documents cited in each state's SSR. Subsequent lists included only remaining documents. The final list, generated from the database, included only documents published by that agency. Agencies supplied copies of reports as they could be located and copied.

The creation of a sample set of fully cataloged citations provided the opportunity for searching, not only of the sample, but of the full list of citations. During this testing, it became evident that the database is extremely sensitive to both the terms used in cataloging and the entry of data into the database fields. Accurate and consistent data entry is essential.

Thesaurus

A survey of documents on hand revealed lack of consistent use of fishery terms. In order to document the AFIS databases and facilitate searching of the AFRS, it was necessary to develop a standard set of terms for the CIS. Development and application of a structured thesaurus of Columbia Basin fishery terms was the most feasible approach.

A thesaurus is composed of both a standard set of terms, called descriptors, and a structure which relates terms in a hierarchical fashion (Appendix C). The purpose of a thesaurus is to classify information for efficient and accurate retrieval by database users. Searching by descriptors provides the speediest, most accurate searching.

The initial list of descriptors for the thesaurus were chosen from established indexes, some of which included:
- CIS User Needs Survey
- CIS Data Catalog.
- Idaho Department of Fish and Game Library Keywords
- 1993 Intermountain Fishery Abstracts
- Aquatic Sciences and Fisheries Information System Thesaurus
- Fish and Wildlife Reference Service Thesaurus

The full list of terms is broader than needed for the initial thesaurus and serves as a customized "library" of terms from which we chose those best suited to the Basin. The choices were based upon usage in the Basin.

The thesaurus is being used for the initial catalog prototyping and testing and is being continually updated and expanded. Documents will be cataloged at the most specific level appropriate. As the electronic version of the thesaurus is developed, screens will offer searchers both broader and related terms. Some subject areas are mandatory (if applicable to a particular document) and other subject areas are discretionary. Thus all documents will be cataloged by the species, life stage, subbasin, and funding source, for example.

The accomplishments of Phase 3 (FY93) of the CIS project form the infrastructure for the full development of the Literature Catalog and CIS Library. The five elements of the infrastructure follow:

1. Establishment of a physical location for organization of documents for storage and retrieval;
2. Completion of prototype database system for storage and retrieval of document information;
3. Verified citations from the Stock Summary Reports are in a database format, complete with linking codes to the AFIS;
4. A sample set of full cataloging, including USGS hydrologic unit codes and abstracting; and
5. Completion of a working version of a thesaurus, including terms and structure.

From the development and testing of the prototype, the following points became evident:

1. A standard for document citations needs to be developed and adhered to by participating agencies;
2. A copy of the document for full cataloguing is essential:
3. Absolute accuracy and consistency in data entry is essential;
4. Full cataloguing requires knowledge of the Basin and of fishery science; and
5. Full cataloguing requires 20 to 30 minutes per document. Additional time is necessary if no abstract is provided in the document.

Data Catalog

The Data Catalog (O'Connor 1992) is another major component of AFRS; it consists of a Dataset Directory and a Data Item Directory. Text describing the 92 datasets currently listed in the Dataset Directory was loaded into an electronic database and added to the CIS Distributed System. Search and retrieval capabilities are currently being improved by efforts to key all freshwater geographic references to USGS hydrologic units and to standardize the terminology used in the List of Data Items field. Initial efforts to build code tables needed for standardization were begun in September. The complete cross-referencing and standardization of terms will be completed by November.

The May, 1993 report was re-verified before loading the database. Prior to the first production release of the system, we mailed out letters to each of the current dataset contacts asking for additions or corrections to what we had published. Several of the contacts responded with phone number changes, the names of newly-assigned dataset contacts, or clarified information in one of the other fields. All changes received by mid-October will be incorporated in the production release; subsequent changes will be reflected in future releases.

Upon review of the September release of the Dataset Directory contents, Steering Committee members suggested changes involving the organization and presentation of species presence information in each dataset. The changes were incorporated to streamline the data tables used even further, and to simplify the on-screen appearance of each dataset description.

In the original CIS Report on Information Needs (Weber et al. 1993) respondents were asked if they collected or maintained collections of data in each of the Natural Production, Hatchery Production, Habitat or System categories we defined. Those that did could act as potential sources of this information, and were termed "Data Item Directory data contacts." A database of these contacts (names, addresses, data item cross-reference codes) was built in order to verify the current status of these people as data sources. Matching up each contact with all of the categories of data for which they responded "Yes" is a complicated chore, but we plan to have a verification letter similar to the one we sent to Dataset Directory contacts sent by early November, 1993.

Table 3. A summary of information **contained in,** or *planned for,* the Anadromous Fish
Reference System, FY 1993.

DATA CATALOG	LITERATURE CATALOG	PROJECT CATALOG
Data set directory	**Reference database**	*Project database*
Data item directory	**Physical collection**	
Data archive/retrieval	*Electronic access to other library collections (through Internet)*	

Information Sharing

Two of the most important and continuing tasks for CIS to accomplish are coordination of
various CIS-sponsored activities and coordination with other data management efforts in the
region. We responded to these needs in a number of different ways, all of which can be
described as "information sharing." The following sections provide an overview of the year's
activities involving several aspects of information sharing.

Communication and Coordination

The CIS Project Manager gave several multimedia presentations on the goals and
accomplishments of the CIS to regional groups, including Bonneville Power Administration,
the Scientific Review Group of the Northwest Power Planning Council, and a National
Marine Fisheries Service workshop involving parties affected by Endangered Species Act
enforcement in the Columbia Basin. The purpose of these presentations is two-fold; we want
to inform others about our work to avoid duplication of effort, and we want our direction to
remain abreast of current needs.

In the past year coordination efforts of the CIS project team included the following:

> Northwest Power Planning Council - CIS staff worked with NPPC staff on further
> defining and implementing the framework for the data needed for monitoring and
> evaluation. Efforts in FY93 also included discussion and transfer of data sets from the
> NPPC to the CIS and future production of the information necessary for an annual
> monitoring report.

Bonneville Power Administration - CIS participants have worked and coordinated with BPA on a number of projects and issues in FY93. Some of these efforts included presentations to BPA staff, coordination with other BPA funded projects, and participation with the BPA GIS Team.

U.S. Fish and Wildlife Service - A number of meetings and discussions took place over the past year with USFWS staff, in particular with the Wild Stock Assessment Team and with the USFWS IHOT representative. The USFWS has indicated strong interest in assisting the CIS project, and further expanding the scope of the project to include information outside of the Columbia Basin.

National Marine Fisheries Service - Several meetings have been held with NMFS staff and the CIS Program Manager participated in a NMFS sponsored workshop. The new NMFS Steering Committee representative up to speed. Increased coordination between NMFS and the CIS project is expected in FY94.

Pacific States Marine Fisheries Commission - The PSMFC is the managing agency for the CIS and has responsibility for several other major coast-wide database systems, some of which include: the Coded-Wire Tag Database, Pit Tag Database, and PACFIN. Coordination efforts with PSMFC in FY93 primarily included internal coordination and communication, and working with the CWT data managers on data requests. The CIS is quickly becoming a functional part of what the PSMFC provides to regional data users. PSMFC also facilitated a coordination session for a number of information system and data driven projects, including CIS.

Northwest Environmental Database - The NED, a BPA sponsored regional project, could be considered as a sister database to CIS. Coordination and work efforts with the NED in FY93 have included shared programming and system development (FrontEnd used for both); shared efforts in completing the 1: 100,000 scale hydrography/EPA reach upgrade, with NED staff taking the lead; discussions and shared planning for future work efforts; etc. NED will be undertaking a major update in FY95 and CIS staff will assist where possible, necessary, or requested.

Integrated Hatchery Operations Team - The NPPC identified the initial link between the IHOT and CIS projects in their Strategy for Salmon document. Coordination and joint work efforts between the two groups were initiated in FY93 through several meetings, presentations, and discussions, and will be more formally defined in FY94.

Scientific Review Group - The CIS Program Manager gave a presentation on the CIS project and a demonstration of the Distributed CIS to the SRG, a group formed to provide independent scientific review and recommendations on Basin fish and wildlife projects. Comments and feedback from the SRG were very positive and the group wanted to keep a communication channel open on progress, and receive products as produced.

Columbia Basin Fish and Wildlife Authority - Coordination and communication with the CBFWA in FY93 has focused on project updates, presentations to several CBFWA facilitated groups (eg. IHOT, SRG), sharing of bulletin board experience (both CBFWA and CIS use the same software), and initial work with the Fish Passage Center on coordination and CIS summary data needs.

Comprehensive Environmental Assessment - The CEA, started in FY93, will be a major CIS information/data user over the next year. Initial coordination and work efforts were begun in FY93 which included starting to define what the data needs will be for the CEA project and which of those needs can be met by the CIS.

Washington "Salmon and Steelhead Stock Inventory" - The State of Washington completed their first SASS1 efforts in the past year and CIS coordination efforts have included discussions on the possibility of providing and maintaining the information through CIS, as well as the possibilities of Oregon and Idaho doing something similar.

Oregon Trout - Oregon Trout began an effort in FY93 to inventory and identify "healthy" stocks of anadromous fish in the Northwest. CIS participants commented on draft assessment documents and coordinated, where possible, efforts of Oregon Trout contractors to access the information defined for their efforts. It was also agreed that this might be a good data set for CIS to provide in the future.

Klamath River Basin CIS - This is an effort under development in California, and is a good demonstration of sharing ideas, etc. between projects. This may prove to be a good test area for the possible expansion of the CIS, as proposed by the USFWS.

Library/Reference Coordination - The CIS Librarian coordinated with a number of other information and reference resources for purposes of using/accessing existing collections of information, where possible, and for gaining valuable insight and experience from fishery librarians involved with other information services. Primary contacts included the University of Washington, Oregon State University, and the National Marine Fisheries Service libraries. Two professional organizations, the Natural Resources Information Centers and the International Association of Marine Science Libraries and Information Centers, have proven to be valuable sources of advice and documents.

The CIS Program Manager, the CIS Librarian, and several members of the Steering Committee have also begun assisting regional workers with data requests and advice. The need for current information or pointers to people that maintain data never disappears; occasionally even the best of distributed systems cannot be as effective as a quick phone call to the right person. To that end, the CIS Steering Committee has placed a high priority on responsiveness to individual requests, and "people-ware" is an extremely important part of the toolbox.

CISNET Bulletin Board System

The CISNET Bulletin Board system has been maintained for several years by the CIS project both as a tool for development and review of work products and as a service for other regional ghing to use available technology to improve group communication. CISNET provides an electronic mail box where group members can leave and/or retrieve messages and documents for each other. The bulletin board approach has significant advantages over alternative methods for facilitating group activity. It is faster than faxing or mailing paper copies of material. Because all material is in electronic form, the recipient can have full access to documents to make comments, changes, or additions. Privacy can be protected and senders can be notified automatically that messages have been received, thus virtually eliminating lost material. Finally, senders and receivers can access the system when it is convenient for them, and are not restricted to normal working hours or others' schedules.

Both the use of CISNET and the technical sophistication of users themselves have increased over the last fiscal year. Calls to the CISNET have approximately doubled (Table 4), with most of the increase occurring since May, 1993. The use of faster modems (9600 bits per second) is more common now and decreases connect time costs for users. While file transfers have remained approximately constant, the use of message features has increased significantly. The practice of attaching files to messages is more convenient for all users, is easier to maintain privacy, and reduces the likelihood of recipients missing important documents.

As would be expected, the times of greatest usage are between 8:00 a.m. and 5:00 p.m., Monday through Friday. Weekend usage is also important and the only period with no calls was between 4:00 and 5:00 a.m. Calls during recent mid-week periods have averaged 51 per day with an average connect time of about 4 minutes each. This means that the CISNET is being used about 42 percent of the time during normal business hours. This is consistent with user comments that they are encountering busy signals more frequently.

Table **4. Summary of** CISNET usage in FY93.

NUMBER MESSAGES	TOTAL CALLS	9600 BPS CALLS	
OCTOBER	124	38.7	22
NOVEMBER	107	44.6	5
DECEMBER	68	48.4	4
JANUARY	48	43.2	3
FEBRUARY	71	44.1	3
MARCH	146	57.6	8
APRIL	150	54.6	13
MAY	200	52.9	24
JUNE	199	45.8	55
JULY	236	64.9	70
AUGUST	233	67.6	65
SEPTEMBER	241	44.8	50
TOTAL	1 8 2 3	52.9	322

Library Services

The CIS will provide both a catalog of basin grey literature and, subject to funding, a source for documents. The demand for, and cost of document delivery was separately investigated by the CRITFC in FY93. That experience is probably typical of document demand in other state and federal resource management organizations. Tables 5 and 6 display the types of requests and describe the sources of documents.

Requests originated both internally and from public agencies, privately funded organizations or consultants, and the general public. A document request is defined as a request, at a citation level, that can be answered with a specific document(s). An information request is defined as a request for information that does not specify a document. Information requests

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ranged from a question on the origin of a name to a comprehensive (national) list of information sources. Requests from the private sector that could not be filled internally, and thus would incur an additional cost, were referred to other sources.

The need for, and use of document delivery service was stronger than expected in this limited test. We have not estimated the staff costs of providing this assistance, but other comparable services we examined charged at least $10 to $15 per article. If speed were not a factor, some of these might have been obtained more economically through established inter-library loan procedures. Work during FY94 will examine these issues further as they apply to delivery of grey literature.

Table 5. Sources of documents.

SOURCE	DESCRIPTION	COST and ACCESS
U.S. Fish and Wildlife Reference Service (FWRS)	Collection and database of USFWS reports, others supplied by state agencies.	One document per week free to USFWS staff or cooperators (states, tribes).
University of Washington Resource Sharing Service (UWRSS)	Not-for-profit document delivery and inter-library loan service.	Standard $10.00 charge includes invoice an copyright fees.
Northwest and Alaska Fisheries Center Library (NMFS)	Library serving NMFS regional and field offices.	Extremely limited outside of staff. Library is not funded for full-scale document delivery service.
Article Express (AE)	Commercial, for-profit document delivery business.	Standard $15 .OO charge includes copyright fees.

Table 6. Number and disposition of information and document requests.

REQUESTOR	INFORMATION			DOCUMENT		
	Filled Internal	Filled External	Referred	Filled Internal	Filled External	Referred
Scientist	5	5	0	0	169	4
Policy/Manager	0	0	0	0	8	4
Public Agency	9	1	0	0	2	1
Private Sector	2	1	2	1	0	3
Public	0	2	1	0	0	0
TOTAL	16	9	3	1	179	12
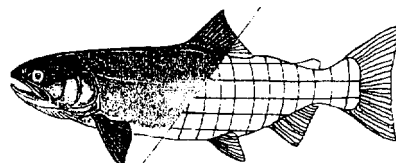
CURRENT ASSESSMENT

The following section of this report provides a current assessment of the CIS project. Appendix B describes tasks and progress on completing each of those tasks. Additional avenues for feedback and assessment of the project included the user feedback on prototype testing which are described in detail in the CIS Distributed System Documentation Report (Reece et al. 1993).

Organization and Administration

Hiring a full time project manager and locating the CIS office within the PSMFC will assist in centralization of data and services where necessary, and will provide a logical location for this function. PSMFC was already established as the location of several large regional and coast-wide data management projects, and was also considered a "neutral" location by the Steering Committee, BPA, NPPC, and the Columbia Basin Fish and Wildlife Authority Liaison Group.

The CIS Steering Committee continues to function well in providing the daily guidance necessary to keep this complex project on track, and in providing the information exchange necessary within the members' respective organizations and states. One new organization was added to the Steering Committee in FY93, the National Marine Fisheries Service (NMFS). The expanding role of the NMFS in Columbia Basin anadromous fish management, and their subsequent need for regionally accessible information, has provided an excellent example of the need for the CIS and their increased interest in the project.

System Development

The CIS Steering Committee decision to use the "Front End" system (FES) as the internal infrastructure for the CIS has clear advantages. The proven flexibility, portability and expandability of the FES provides the perfect environment for the quickly growing and changing CIS applications. The FES is also being used for the distributed Northwest Environmental Database state river systems.

The decision to formalize a Programming "Team" also worked out extremely well, with a half-time Systems Analyst and full-time Programmer located in Boise, and a full-time Programmer located in Olympia. Some concern was expressed early on that a programmer located away from the Team would not function very well, but these concerns diminished as the year progressed. The Team used the CISNET extensively for getting data and information back and forth to each other.

Data Development

Development of the data structures and compilation/formatting of the data required for components of the AFIS have been excellent. Progress was somewhat slowed because of difficulties encountered in bringing Stock Summary Report data into standard database format. Time was also not available for generating all of the more detailed standard data sets necessary for automatic update of the summary data provided in the Distributed System. IDFG staff have begun this effort in order to provide the requested standard summary data sets for Idaho subbasins. This should provide an excellent framework for work in FY94. The base structure for the Hatchery Production database(s) was also started in FY93 and will be a major focus of early FY94 work.

The framework has been built for a truly useful AFRS. The Data Set Directory was updated and is provided as a component of the Distributed System. The Data Item Directory has not been included yet, but will be as soon as review and update have been completed. A good start on the Literature Catalog is included with the initial Distributed System, including all references used in the Stock Summary Reports. Full cataloging of references was begun and with adequate resources in FY94 to catalog all references, the Literature Catalog will be an extremely valuable addition and tool for CIS users.

Coordination and Integration

Coordination efforts are summarized in the Accomplishments section. These efforts will continue and expand further in FY94. The result of coordination activities is that more agencies are aware of CIS services and more potential data sources have been identified.

Services and Features

The initial services and features provided by the CIS project are fully described in the CIS Services and Features Report (Tinus et al. 1993). The current assessment of services and features to be provided starting in FY94 clearly indicates a wide range of options for users of the CIS to access information, data, literature, and people. The participating organizations have committed highly qualified and professional staff to the users of the CIS and the full range of services and features of this system can be found nowhere else.

Overall Assessment

As with most multi-state, multi-organizational, multi-individual projects, the CIS project has experienced its moments of struggle in developing and implementing a shared vision. This has

caused some delays in the past, but each step has been a learning process that ultimately strengthened the project. Participants in the CIS project became a functional team in FY93. The dream of actually having a user friendly system for accessing anadromous fish information is becoming a reality, and with stable funding and a lot of hard work the project will be a successful addition to the regional and state data efforts far into the future.
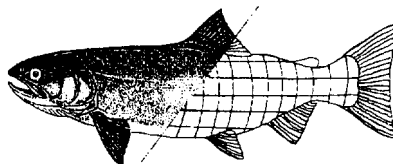
FUTURE DIRECTIONS

Products of the Coordinated Information System will be available to users in early FY94. As widespread distribution is essential for success, CIS will promote and distribute its deliverables and services throughout the region. The project will also provide training to users to acquaint them with the various products. Based on feedback from the various users, steps will be taken to improve the organization of CIS data to ensure effective maintenance and updating of the information and databases. Anticipated improvements in FY94 will include enhancements to both AFIS and AFRS data, the Distributed System, and project management.

AFIS Data Enhancements

Summary databases will be updated with information available through 1993. In addition, data structures of the Distributed System will be analyzed and improved, and standardized formats for detailed data will be defined. These changes will result in updated SSR tables along with new standardized tables for natural and hatchery production databases, and current and new standardized tables for the system-level databases. A habitat database to assist in basin-wide monitoring and evaluation efforts will be developed. New data items (e.g., resident trout) identified by regional groups will be compiled into a CIS format as feasible. As changes occur, the Distributed System will be updated and distributed.

AFRS Data Enhancements

Through an electronic survey and additional contacts, the Data Catalog will be updated. The library collection will continue to expand as new documents are received. The reference components of the Distributed System will be improved and a document delivery system explored. A prototype of a project catalog, incorporating aspects of Bonneville Power Administration's Project Management Information System, will be designed.

During the next phase of the CIS, further development of the Literature Catalog will take the following three forms:
1. Expansion of the Literature Catalog;
2. Exploration of options to streamline acquisition and cataloguing; and
3. Exploration of options for document delivery.

The first will include continuing the full cataloguing of existing citations. Other citation lists, including published literature, will be sought.

Options to streamline acquisition of documents and full cataloguing, including the purchase of cataloguing from existing databases, contract cataloguing, and custom cataloguing, will be explored.

Options for providing document delivery service, including potential cost recovery for copying, transmission, and copyright fees (for published literature), will be explored.

Distributed System Enhancements

Formats will be defined such that detailed datasets can be used to generate summary data. Based on user feedback, the system FrontEnd will be refined including improving access to CIS through, for example, CISNET and networking. Reporting capabilities will be expanded with increased options for users on how data are displayed and reported. Linkage or interface between CIS and the Northwest Environmental Database will be developed. All system documentation will be updated and distributed.

As use and user needs and capabilities increase, the CISNET will have to improve also if the same measure of service is to be maintained. The greatest future needs are for funds to support a part-time sysop, updated and rewritten user manuals, addition of a second phone line to reduce the number of busy signals received, and the addition of higher speed modems (V.32bis or above) to improve service and reduce cost to users.

Project Management

A management structure to maintain the CIS databases and information bases will be formally established. CIS will continue to be promoted regionally and nationally. CIS will also continue to coordinate with other regional data efforts and information management activities. A training program will be developed to assist CIS users, including on-site training. Database updating will continue.

The major change in the CIS Project beginning in FY94 is the move from a prototype and development mode to "production" mode. CIS deliverables will see widespread distribution and use, user training will take place, use of CIS services will be promoted through the efforts of member agencies, and data organization will be improved to facilitate maintenance and updating of the information and data bases.
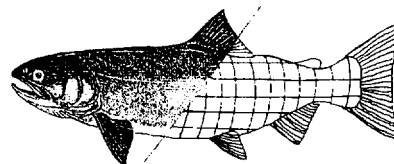
LITERATURE CITED

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APPENDIX A. CIS Participants in FY93

Bonneville Power Administration
     Katherine Beale
Columbia River Inter-Tribal Fish Commission
     Phil Roger
     Ann Roseberry
     Keith Hatch
Idaho Department of Fish and Game
     Jerome Hansen
     Doug Reece
     Daniel King
     Charlie Petrosky
     Terry Elms
     Kelly Duren
National Marine Fisheries Service
     Steve Stone
Northwest Power Planning Council
     Duane Anderson
Oregon Department of Fish and Wildlife
     Erik Olsen
     Eric Tinus
Pacific States Marine Fisheries Commission
     Stan Allen
Shoshone-Bannock Tribes
     Mike Rowe
U.S. Fish and Wildlife Service
     Travis Coley
Washington Department of Fisheries
     Dick O'Connor
     Larry Brown
     Bob Woodard
Washington Department of Wildlife
     Peter Hahn
     Martin Genrich

APPENDIX B. FY93 Task List, Discussion, and Status

The following is an abbreviated task list for the CIS project in FY93. Following each task is a discussion about work completed, products produced, task status, and if warranted, further work that will be accomplished.

1.1 Initial Services and Features

The initial task report was due at the end of Month 3. The CIS Program Manager prepared an Initial Services and Features presentation/report which was reviewed and finalized at the March CIS Steering Committee meeting. The presentation was given to BPA staff and management in May, and to a number of other groups as was deemed necessary, or was requested. Hardcopy versions of this presentation were provided to all participants and anyone else wishing to know more about CIS. A more formal CIS Services and Features report has been prepared as an FY93 deliverable (Tinus et al. 1993).

Status: Completed. A slide show and demonstration of the prototype CIS was developed. The presentation will continue to be modified to provide more detail as development occurs.

1.2 Define format and content of M&E tables

Draft M&E tables were developed and reviewed by the Steering Committee. Revisions were made as necessary. The format and content of M&E tables for mainstem catch data, mainstem dam count data, and smolt passage indices were included in FY93 work.

Status: Completed. As work continues in FY94, the format and content of M&E tables will be modified as necessary.

1.3 Develop structure/coding for AFIS summary databases

Initial structure and coding was completed for SSR and M&E tables. A unique code for identifying each SSR table and its contents was developed (CISKEY). The code contains information pertaining to stock, sub-basin, and wild/natural - hatchery delineation. Necessary data elements, based on standardized tables have been identified. Computer data entry forms were developed in conjunction with Task 1.4. Some modifications were necessary as SSR data was brought in.

Status: Completed. Will continue to be modified as necessary for successful integration with data coming in and the necessary cross-linking with AFRS.

1.4 Software module to enter/edit AFIS data

By using the FrontEnd developed at IDFG, the software module to enter/edit data contained in AFIS was made available. This feature also allows password only access to modify (enter/edit) the data. The ability to enter/edit data will be turned "off" in the distributed CIS. In FY94 the ability for users to export selected data to a separate file will be made available.

Status: Completed. Available immediately as new components are brought into the system.

1.5 Assemble, convert, store data for SSR and M&E tables

A major portion of the data contained in the SSR documents has been converted to the standard data structure established for the initial Distributed System. Due to the difficulty in providing data in the SSR standard summary table format, IDGF focused their state level efforts on building the standard intermediate level historical data sets necessary. Nearly all of the necessary M&E data have been assembled, converted and stored in dBase format and have been incorporated into the system.

Status: Completed for Initial Distributed System and Ongoing.

1.6 Develop user interface, output options for AFIS

By using the FrontEnd, this task was implemented quickly. After three prototype releases the user interface became more user friendly, flexible, and intuitive. As more users provide suggestions for enhancement, the user interface will get nothing but better. Output options are currently pre-defined by what you see on the screen but a good start on a user definable report is available in the initial Distributed System. Several of the more common printer drivers have also been made available.

Status: Completed.

1.7 Test AFIS

Testing of three AFIS prototypes was completed in FY93, leading to the initial Distributed System.

Status: Completed and Ongoing.

1.8   Revisions to AFIS from testing

Revisions were made based on comments and suggestions received on the three prototype versions.

Status: Completed and Ongoing.

2.1   Initial services and features

This is the AFRS component of the Initial Services and Features presentation/report discussed in Task 1.1. A summary of the services and features that will be supported by the Data Catalog and Literature Catalog has been completed, and draft access policies have been developed. More detail on initial AFRS services and features is provided in the FY93 Services and Features Report (Tinus et al. 1993)

Status: Completed. Will continue to be modified as necessary as development proceeds in FY94.

2.2   Develop format/content of output from AFRS catalogs

Completed for the Data Catalog directories, with some slight modification when the thesaurus is completed and cross-referenced. Format and content of the Library Reference System has been completed and will be modified only if necessary for integration with the AFIS components of the CIS.

Status: Completed.

2.3   Initial structure and coding of AFRS catalogs

The initial structure and coding scheme for the AFRS catalogs has been completed and converted to database format. This information was delivered to IDFG and incorporated into system development.

Status: Completed.

2.4   Software module to enter/edit AFRS data

Is completed as AFRS data is brought into the FrontEnd. The ability to modify the data (enter/edit) is password protected Enter/edit capability will be "turned off" in the publicly distributed system.

Status: Completed.

2.5   Assemble, convert, store data for AFRS catalogs

The Data Catalog components are complete with an update completed for the Data Set Directory. The Data Item Directory will be made available shortly after review and update are completed in early FY94. The Library Reference System includes citations for all the documents identified in the Stock Summary Reports. Full cataloging was done for a subset of these documents for prototype development. Full cataloging and the incorporation of additional citations will continue in FY94. The Distributed System presently contains all references used in the SSR's.

Status: Completed and Ongoing.

2.6   Develop user interface, output options for AFRS

By using the FrontEnd, this task was completed as data was brought into the AFRS modules. See Task 1.6

Status: Completed and Ongoing

2.7   Test AFRS

Testing AFRS software modules was conducted in conjunction with efforts identified in Task 1.7. A log of comments, suggestions and problems and encountered and resolution during prototype testing was maintained and is reported in the Distributed System Specifications report (Reece et al. 1993).

Status: Completed and Ongoing

2.8   Revisions to AFRS from testing

Revisions will be made as testing occurs and agreement is reached by the Steering Committee. See reference above.

Status: Completed and Ongoing,

2.9   Develop physical CIS Library

Approximately 60% of the referenced literature in SSR reports has been received in hardcopy form. Work was focused on obtaining these documents and starting the full cataloging process. Library shelving needs were identified and necessary purchases made. Shared funding was provided by CRITFC.

Status: Started. Ongoing

3.1 Coordinate activities; Project Management

Maintenance of the CIS bulletin board continues. A file clean-up effort was undertaken and was completed. An activities report for bulletin board use was produced. The CIS Program Manager has set up central files and has produced results/meeting minutes from all FY93 Steering Committee meetings, which were held approximately once per month. A CIS project planning calendar was produced and distributed, identifying meeting dates and outlining task start/end dates. Major efforts were undertaken to coordinate and communicate with other projects, work groups and organizations.

Status: Completed and Ongoing.

3.2 Identify hardware/software to be used for development

This is described fully in the Distributed System Documentation report (Reece and Brown 1993). Development of the CIS system was and is being done on 486 PC's located at the Idaho Department of Fish and Game. Data work was done on a variety of 386 and 486 PC's. Database software used included dBase IV and Paradox. All data were converted to dBase IV for the CIS Distributed System. System programming was done in C + + , a powerful and flexible programming language.

Status: Completed.

3.3 Recruit CIS Review Team

The review team consisted of the Program Manager, who coordinated review with BPA and the NPPC, all Steering Committee members, who coordinated review within their respective organizations, and other reviewers deemed necessary, beneficial, or requested based on what was being reviewed. A complete list of prototype reviewers can be provided.

Status: Completed.

3.4 Coordinate with related projects/data efforts

The CIS Project Manager and Steering Committee members have continued to meet with, coordinate with, and integrate efforts where possible. Coordination meetings have taken place with the NED, IHOT, PMIS, CWT, and modelling projects in the past year. Detail on these efforts is more fully described in the text of the FY93 Annual Report and in Quarterly Reports.

Status: <u>Completed and Ongoing</u>.

3.5   Produce a Project Summary Report

This report was referred to as a Summary Report in FY92 and will now be referred to as an Annual Report (this document).

Status: <u>Completed</u>.

3.6   Develop integration methodology for CIS databases

The key codes and fields necessary to integrate the various CIS databases have been developed and put in place, or are in the process of being developed. This process will continue as the different components are brought into the main distributed system structure.

Status: <u>Completed</u>

3.7   Develop interactive user interface to all CIS products

By using the FrontEnd, and as various components of the CIS system were brought together, this was completed. The overall structure of the system has been defined.

Status: <u>Completed and Ongoing</u>.

3.8   Test FrontEnd software

Three prototype versions of the CIS Distributed System were released for testing in FY93. Testing will continue in FY94 as new components continue to be brought in.

Status: <u>Completed and Ongoing</u>

3.9   Revisions based on testing FrontEnd

Revisions and enhancements were made to the FrontEnd in the past year, nearly all of which were approved by group consensus after prototype testing. Detailed documentation of comments and system revisions can be found in the CIS Distributed System Documentation report (Reece et al. 1993) described in Task 3.10.

Status: <u>Completed and Ongoing</u>

3.10 Prepare draft specifications reports (program/database documentation, user manual, etc.)

These reports have been provided as FY93 CIS Distributed System Users Guide (King et al. 1993) and CIS Distributed System Documentation report (Reece et al. 1993). Both of these documents will be updated and enhanced in FY94.

Status: Completed and Ongoing

APPENDIX C. Draft CIS Thesaurus

The CIS thesaurus is presently organized into seven categories each identified by a lead term or terms and a scope note briefly describing the terms included under each lead term. Based upon a hierarchical structure commonly used by libraries and online indexes, the thesaurus is organized in an outline form where each level (except the lead term and associated scope note) in the outline signifies the relationship between terms as shown in the following example.

MORPHOLOGY

length
    total length
    fork length
    hypural length
    standard length
weight
    total weight
    round weight
fin
    fin ray
scale
    annulus
    circulus
    scale count

Terms in each level of the outline are equivalent to each other, broader to all terms in the levels immediately below it, and narrower than the term immediately above it in the outline. In some cases, notes may be associated with a particular term to provide additional information as:

SPECIES (MANDATORY)

Char UF *Salvalinus*
    Brook trout UF *Salvalinus fontinalis*
    Bull trout UF *Salvalinus confluentus*

The term "species (mandatory)" indicates this is a class of descriptors which is used in the catalog database and must be included in the document description, if appropriate. The notes following species common names indicate that common names are "used for" the scientific

name in the document description. Thus, someone searching for references for "Salvalinus" would not find any but would be directed to use "char" for the search term instead of the scientific name.

The thesaurus is still undergoing active review, modification, and development. It is being used to standardize the descriptors applied to documents as they are cataloged, and will be implemented in a future electronic version of the CIS.

I. BIOLOGY AND RELATED TERMS

S.N.   Descriptors that define living organisms, their anatomy, **physiology, development,** behavior, ecology, and populations.

ANATOMY

PHYSIOLOGY

       growth

MORPHOLOGY

       length
              total length
              fork length
              hypural length
              standard length
       weight
              total weight
              round weight
       fin
              fin ray
       scale
              annulus
              circulus
              scale count
       gill raker
       pyloric cecae

BEHAVIOR

       homing
       immigration
       instinct
       migration

predation
social
feeding

ECOLOGY

species diversity
competition
predation
allopatry
sympatry
biota
ecosys tern
interactions
limiting factors
niches
trophic structure

DISEASE

dissolved gases
overcrowding
pathogens
    bacteria
        BKD
    virus
        VHN
    fungus
        Saprolegnia
stress
parasite
virology
histopathology
hematology
    blood chemistry
bacteriology
mycology
treatment
    drug
    chemical

GENETICS

          adaptations
          breeding
          brood stocks
          divergence
          electrophoresis
          hybrids
          inbreeding
          natural selection
          sterilization

HABITAT

light
temperature
riparian area
sediment
water quality
water quantity
suitability

LIMNOLOGY

LIFE HISTORY

Incubation
        egg
        alevin
        larva

Juvenile
        parr
        fry
        fingerling
        pre-smolt
        smolt
        migrants

Adult
        redd
        spawner

immature
mature
pre-spawner
carcass
jack
escapement
survey
       spawning ground survey
migrants

POPULATION DYNAMICS

age composition
density
extinction
fecundity
mortality
recruitment
stocks
subpopulations
survival
growth
birth
death
escapement
run size
population vulnerability analysis
      UF pva
cohort analysis
abundance
recruitment

SPECIES (MANDATORY)

Char UF *Salvalinus*
    Brook trout UF *Salvalinus fontinalis*
    Bull trout UF ***Salvalinus confluentus***

Eels UF *Lampetra*
    Lamprey UF *Lampetra tridentata*

Whitefish UF *Prosopium*
    Mountain whitefish UF *Prosopium williamsoni*

Atlantic Salmon UF ***Salmo salar***

Pacific salmon UF *Oncorhynchus*
        Chum UF *0. keta*
        Coho UF *0. kisutch*
        Pink UF *0. gorbuscha*
        Sockeye UF *0. nerka*
        Spring Chinook UF *0. tshawytscha*
        Summer Chinook UF *0. tshawytscha*
        Fall Chinook UF *0. tshawytscha*
            Upriver bright UF *0. tshawytscha*
            Tule UF 0. *tshawytscha*
        Summer Steelhead UF 0. *mykiss*
        Winter Steelhead UF 0. *mykiss*

Sturgeon UF *Acipenser*
        Green UF *Acipenser medirostris*
        White UF *Acipenser transmontanus*

Trout UF Salmo
        Cutthroat UF *Salmo clarki clarki*
        Rainbow UF *Oncorhynchus mykiss*

Squawfish UF *Ptychocheilus oregonensis*

Walleye UF *Stizostedion vitreum*

Catfish UF *Noturus, Ictalurus, Ameiurus*

Shad UF *Alosa sapidissima*

II. NATURAL RESOURCES AND RELATED TERMS

S.N.   Descriptors that define human uses of natural resources.

FISHERIES MANAGEMENT

    Planning

    Harvest

        area
        catch
        season
        CPUE
        effort
        exploitation
        allocation
        protection
        statistics
        gear
        industry
        mortality
        rate
        inr iver
        quota
        catch-and-release
        creel census
        creel surveys
        game fish
        non-retention fishery
        poaching
        public fishing
        sport fishing

    Ocean Fisheries

    Fish Marketing

Production

        Hatchery Production
            reprogramming
            rearing
            stocking
            transplanting
            nutrition
            water quality
            disease
                    disease prevention
                    disease treatment
                    UF pathology
            releases
            breeding strategy
                    UF spawning strategy
            broodstock
            egg take
            incubation
            outplanting

        Natural Production
        (See Biology topics)

        Supplementation
            artificial spawning grounds
            outplanting
            donor stock
            life history

        Aquaculture
            pen rearing
            pond culture
            ocean ranching

POLLUTION

    soil erosion
    cumulative impacts
    thermal pollution
    radioactive pollution

HYDROPOWER

fishways
impoundments
screens
spills
supersaturation
transport
turbines
weirs
diversion dam
fish ladder
hydroelectric dam
locks
interconnected power system
river regulation

AGRICULTURE

diversion dam
grazing
irrigation
range management
range land
watering devices
weed control

FORESTRY

clear cuts
logging
fires
Forest Practices Act
forest plans
forest habitat
National Forests
public land
road building
roadless areas
timber sales
timber
watershed protection
wilderness areas
woodlots

NAVIGATION

    locks
    channel

PASSAGE

III. TECHNIQUES AND RELATED TERMS

S.N.   Descriptors that define methods and equipment for collecting, storing, or analyzing information.

ANALYTIC OPERATIONS

Statistics

    models
    sampling

Data

    chemical marking
    CWT
            release
            recovery
            technology
            analysis
    PIT tag

LABORATORY EQUIPMENT AND METHODS

Equipment

Methods

FIELD EQUIPMENT and METHODS

Equipment

Methods

    survey
            spawning ground survey
            creel survey
    inventory
    sampling
    censusing
    counts
    mapping
    marking
    trapping

video counting

REPORTING METHODS

bibliographies
handbooks
illustrations
status report
studies
surveys
thesaurus
annual report
progress report
quarterly report
proposal
literature review
editorial
abstract
video
map
letter
memorandum
fax

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IV. GEOGRAPHY

S.N.   Descriptors that define political geography or human constructions.

ANALYTIC OPERATIONS

GIS

ECOLOGICAL DIVISIONS

aquifer
benthos
desert
ecoregion
forest
grassland
prairie
scrub
wetland
riparian
aquatic
marine

LAND USE DESIGNATIONS

grazing/range land
irrigated farmland
military
mines
power line right of way
railroad right of way
road right of way
private
public
reservoirs
timber
wilderness

Official Designations

Indian Reservation
National Monument
National Park
National Wildlife Refuge
National Forest
National Recreation Area
National Historic Site
State Monument (?)
State Park
State Forest
Wild and Scenic River

GEOGRAPHY

Political
u s
North America
Canada
Pacific Coast
Columbia Basin
Alaska
British Columbia
Washington
Oregon
Idaho
California
West Atlantic
East Atlantic

DAMS

Mainstem Dams

Bonneville Dam
The Dalles Dam
John Day Dam
McNary Dam
Priest Rapids Dam
Wanapum Dam
Rock Island Dam
Rocky Reach Dam
Wells Dam
Chief Joseph Dam
Grand Coulee Dam

Ice Harbor Dam
Lower Monumental Dam
Little Goose Dam
Lower Granite Dam
Oxbow Dam

Tributary dams

Idaho

Oregon

Washington

HATCHERIES, RELEASE SITES\PONDS\TRAPS

Oregon Hatcheries

Oregon Release Site/Ponds/Traps

Washinqton Hatcheries

Washington Release Sites/Ponds/Traps

Idaho Hatcheries

Idaho Release Sites/Ponds/Traps

OCEAN CATCH AREAS

SUBBASINS

Columbia River Basin
Lower Columbia River
Willamette River
Clackamas
Coast Fork
Coast Range
Long Tom
McKenzie
Mid-Willamette

Middle Fork Willamette
Molalla
Santiam
Tualatin
Cowlitz
Elochoman
Grays
Kalama
Lewis
Sandy
Washougal

Mid-Columbia River
Deschutes
15 Mile
Hood River
John Day
Klickitat
Umatilla
Walla Walla
White Salmon
Wind

Upper Columbia River
Entiat
Methow
Okanogan
Wenatchee
Yakima

Snake River
Asotin Creek
Clearwater
Lochsa
Lower Mainstem Clearwater
North Fork Clearwater
Selway
South Fork Clearwater
Grande Ronde
Imnaha
Salmon
Lemhi
Little Salmon
Lower Mainstem Salmon
Mid-mainstem Salmon

Middle Fork Salmon
Pahsimeroi
South Fork Salmon
Upper Salmon
Tucannon

Coastal Basins

V. HYDROLOGYANDGEOLOGY

S.N.   Descriptors that define physical properties, characteristics, and phenomena of land, water, air, and the land/water interface.

ANALYTIC OPERATIONS

PHYSICAL AND CHEMICAL PROPERTIES

> permeability

ECOLOGICAL DIVISIONS

Ecoregion
> forest
> grassland
> prairie
> scrub
> wetland
> aquatic
> marine
> desert
> vegetation
> terrain
> headlands
> inlets
> marsh
> lake
> pond
> stream
> subbasin
> tributary
> groundwater
> runoff
> rainfall

Drainage basin
> lake
> sinuosity
> shape

profile
aquifer
delta
estuary
runoff
springs
vegetation
watershed
terrain
headland
inlet
marsh
pond
stream
subbasin
tributary
groundwater
runoff
rainfall
springs

Riparian zone
bank
shade
cover
delta
estuary
marsh
vegetation
undercut

Stream channel
benthos
section
reach
width
slope
depth
cobble
embededness
riffle
pool
run
class
woody debris

pebble count
flow
nutrients
quality
quantity
sediment
silt
solids
supersaturation
temperature
turbidity
velocity
volume
load
braiding
bed
length
particle size
profile
meanders
deltas
estuaries
eddy
undercut
barrier
       diversion
       culvert
       screen
       dam
       waterfall

VI. CHEMISTRY AND RELATED TERMS

S. N.   Descriptors that define chemical elements or compounds, chemical products, organic substances, chemical phenomena, and chemical processes.

CHEMISTRY

BIOCHEMISTRY

VII. LEGAL, POLITICAL, ECONOMIC TERMS

S.N.   Descriptors that define legal, political, and economic aspects of natural resource management.

TREATY

LITIGATION

    International Litigation

    Federal Litigation

    State Litigation

LEGISLATION

    International Legislation

    Federal Legislation

        Clean Air Act
        Clean Water Act
        Desert Land and Carey Act
        Endangered Species Act
        General Mining Law of 1872 (use 1872 Mining Act)
        Indian Reorganization Act
        Indian Self Determination Act (PL9X-638)
        Lower Snake River Compensation Program (LSRCP)
        Marine Mammal Protection Act
        Mitchell Act
        National Forest Management Act
        Northwest Power Planning and Conservation Act

    State Legislation

REGULATION

PLAN (MANDATORY)

Management plan

Mitigation plan

Recovery plan

Integrated System Plan
Subbasin plan
Fish and Wildlife Program

PROGRAM (MANDATORY)

Subheading

Fish and Wildlife Program
System Monitoring and Evaluation Program
Lower Snake River Compensation Program (LSCRP)

POLICY

State
Oregon Wild Fish Policy

AGENCY (MANDATORY)

International

Pacific Salmon Commission

Federal Agency

Bonneville Power Administration
Bureau of Land Management
Bureau of Reclamation
Corps of Engineers
Department of Transportation
Environmental Protection Agency

Federal Energy Regulatory Commission
National Marine Fisheries Service
National Park Service
U.S. Coast Guard
U.S. Forest Service
U.S. Bureau of Indian Affairs
U.S. Department of Commerce
U.S. Department of Interior
U.S. Fish and Wildlife Service

Interstate Agency

State Agency

Idaho Department of Fish and Game
Oregon Department of Fish and Wildlife
Washington Department of Fisheries
Washington Department of Wildlife

Other Agency

Columbia Basin Fish and Wildlife Authority
Columbia River Inter-Tribal Fish Commission
Fish Passage Center
Northwest Indian Fisheries Commission
Northwest Power Planning Council
Pacific States Marine Fisheries Commission

utility

Chelan County PUD
Douglas County PUD
Idaho Power Company
Pacific Power and Light (PPL)
Portland General Electric (PGE)