

Second-Tier Database for Ecosystem Focus

Annual Report
2003 - 2004



This Document should be cited as follows:

University of Washington, Columbia Basin Research, DART Project, "Second-Tier Database for Ecosystem Focus", 2003-2004 Annual Report, Project No. 199601900, 18 electronic pages, (BPA Report DOE/BP-00004124-5)

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This report was funded by the Bonneville Power Administration (BPA), U.S. Department of Energy, as part of BPA's program to protect, mitigate, and enhance fish and wildlife affected by the development and operation of hydroelectric facilities on the Columbia River and its tributaries. The views in this report are the author's and do not necessarily represent the views of BPA.

Second-Tier Database for Ecosystem Focus

Annual Report

October 1, 2003 – September 30, 2004

Contract number
00004124

BPA Project Number
1996-019-00

Prepared by
Columbia Basin Research
DART Project
University of Washington

December 2004

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Abstract

The Second-Tier Database for Ecosystem Focus (Contract 00004124) provides direct and timely public access to Columbia Basin environmental, operational, fishery and riverine data resources for federal, state, public and private entities essential to sound operational and resource management. The database also assists with juvenile and adult mainstem passage modeling supporting federal decisions affecting the operation of the FCRPS.

The Second-Tier Database known as Data Access in Real Time (DART) integrates public data for effective access, consideration and application. DART also provides analysis tools and performance measures for evaluating the condition of Columbia Basin salmonid stocks. These services are critical to BPA's implementation of its fish and wildlife responsibilities under the Endangered Species Act (ESA).

Introduction

Information resources for the Columbia Basin are resident among a diverse number of governmental organizations within the region. Effective management and research of river and fishery issues frequently require timely data access in a format useful for comparison, analysis and decision support. It is precisely this requirement that DART addresses.

DART (Data Access in Real Time) is a second-tier database warehouse containing historic data back as far as 1862 and current real-time data maintained by daily accesses to regional primary-tier sites. By design, DART has been developed to integrate diverse datasets and allow data to be displayed in text and graphical formats via an interactive forms based web-site (<http://www.cbr.washington.edu/dart/>). As users identify data and analysis needs, they are developed and incorporated into DART's capabilities. Project personnel work closely with the primary-tier organizations to ensure quality and timeliness of the data and with end users to provide data utility.

FY 2004 Accomplishments

Year	Accomplishment
2004	Expanded juvenile and adult Columbia Basin ESU populations data services to include: Upper Columbia River Spring Chinook, Upper Willamette Spring Chinook, Mid Columbia River Steelhead, and Lower Columbia River Steelhead.
2004	Acquired and assimilated historical and real-time oxygen saturation data from U.S. Army Corps of Engineers to the river environment data set.
2004	Updated Pacific Northwest Index, a terrestrial climate index, for 1891-2003 based on data from National Climatic Data Center.
2004	Expanded Columbia Basin Performance Measures analysis tool to include exposure calculations for Adult PIT-tag passage to hydrosystem conditions.
2004	Updated analysis services with new Coded Wire Tag Smolt-to-Adult Ratios (SAR) estimates and PIT-tag survival and travel time estimates.
2004	DART served 449,785 individual data requests.

Year	Accomplishment
2004	Provided more than 61 special data analyses by request to users at Idaho Department of Fish and Game, USACE, University of Idaho, WDFW, NOAA, Pacific Institute for the Mathematical Sciences, Virginia Institute of Marine Science, Connell High School, USGS, Idaho Power, Fish Passage Center, Carollo Engineers, Seattle City Light, Nez Perce, DCPUD, CCPUD, GCPUD, PNL, NPPC, Washington State Legislature, John R. Stevenson-Fisheries Biologist, British Petroleum, Lands Energy Consulting, PNGC Power, Farmington High School, Hampton Affiliates, EVS Environment, Mobrand, KWA Ecological Sciences Inc., Grand Valley State University, ODFW, Colville Tribes, Washington State Department of Ecology, Portland State University, and Eastern Oregon University.
2004	Integrated trap collection counts for six trap locations in the Mid-Columbia region with historical and daily data from Chelan PUD, Douglas PUD, Washington Department of Fish and Wildlife, and US Fish and Wildlife Service. The trap data set was integrated with the USGS stream flow data set as part of the DART daily services.
2004	Fully integrated YKFP adult passage data into DART through a distributed database solution.
2004	Added trend statistics to PIT Tag Survival and Travel Time Analysis and Smolt-to-Adult Ratio (SAR) Estimates for Coded Wire Tag.
2004	Adult Escapement for the Columbia Basin data and trend statistics presentation was developed and launched to allow comparison of interim target abundances set by NMFS in their April 2002 memo (http://www.nwr.noaa.gov/occd/InterimTargets.html) with historical trend data.
2004	DART provided data services, programming and web logistics to present the USACE's requested Bonneville daily and cumulated fallback analysis.
2004	Updated and enhanced javaDART to provide improved user interface, menus help, and expanded flexibility. Launched as a java applet.
2004	Provided BPA with potential spill reduction analysis relative to ESU passage in the FCRPS.
2004	Continued integration of data sets from and coordination with primary sites: PSMFC, U.S. Army Corps of Engineers, Grant County PUD, Douglas County PUD, Chelan County PUD, USGS, PFEL, NWS, NCDC, USBR, SnoTel, NOAA, YKFP, USFWS, and Fish Passage Center.
2004	Further developed and enhanced PIT-tag Adult Conversion Rate report and PIT-tag Adult Conversion Rate observation detail report with overwintering and release km information.
2004	Synchronized adult passage data with the adult passage data set available through the USACE Northwest Division's interactive database query system. At the same time, historical chinook run designations were re-assigned to match current run timings as defined by the USACE and YKFP.
2004	Developed and implemented Adult Passage Annual Summary report for total adult salmon passage counts for all adult species at a selected project for all years in the Columbia River DART database (1938 to the present).
2004	Updated and enhanced PIT Tag Adult Returns Observation Summary report to include by Brood Year summary option.

Project Activity

Objective 1 – Data Access in Real Time (DART)

Historical / Real Time Data Integration and Daily Services

Data acquisition from numerous primary sites within the region was performed on a daily basis. Datasets, products and services were integrated within a relational database based on date and location, then immediately made available over the World Wide Web and Internet. Datasets include headwater flows and temperatures, regional climactic data, water quality, project operations, ocean conditions, as well as fish passage, transportation and releases. Text and graphical formats provide current real time information as well as historic data as far back as 1862. Year-to-date updates from the primary sources were applied as available on a daily, weekly and monthly basis. A complete synchronization with PTAGIS data was performed for years 1988 through 2003. SnoTel and climate dataset synchronizations were performed through 2003. USGS historical flow data was updated to capture missing data.

The entire data series of the Yakima-Klickitat adult passage data sets were updated, loaded, and integrated with existing adult passage data. A process for daily synchronization by distributed database procedures was developed and implemented. This is one of the region's first examples in fishery data site cooperation providing a distributed solution to data dissemination.

Tagging session header files and PTAGIS observation records were acquired from PSMFC on a daily basis. The current year's observation total exceeds 960,000 records. Release and observation site datasets were updated to reflect changes and additions.

Daily flow, stage and intermittent temperature data is acquired from 112 USGS sites to provide information concerning headwater conditions. USGS coverage was extended into the Methow and Entiat Rivers to support realtime smolt passage analysis for these basins. Daily temperature and precipitation records from 58 sites throughout the region provide information on weather and climate. Adult passage and smolt passage indices were loaded daily from 13 mainstem dams.

Daily data acquisition continued throughout the year from primary sites. Water quality and operations data including outflow, spill, water temperature and a variety of water quality values including hourly measures were loaded, updated and processed. Salmonid migration data was integrated with these ecological measures.

In support of the Mid-Columbia PUDs, we developed database tables and integrated trap collection counts for six trap locations in the Mid-Columbia region. Historical and daily data were loaded from Chelan PUD, Douglas PUD, Washington Department of Fish and Wildlife, and US Fish and Wildlife Service. The trap data set was integrated with the USGS streamflow data set as part of the DART daily services.

[The Pacific Northwest Climate Index](#) process was updated to provide automated annual updates as data becomes available.

Historical and real time oxygen saturation data from the US Army Corps was assimilated into the water quality data set.

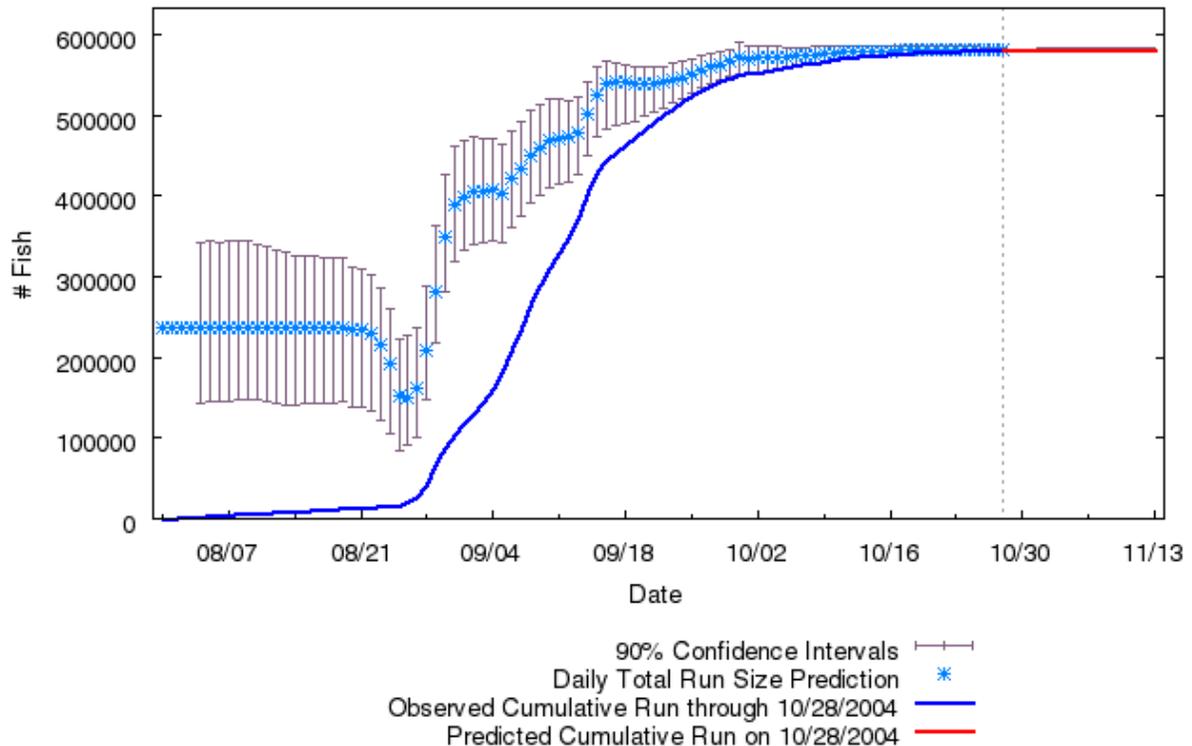
Adult Salmonid Passage

Daily reports of adult passage, year-to-date, and historical averages were made for the mainstem dams and integrated with hydrological information. Ten-year averages were updated to account for missing data. The adult passage dam count dataset was synchronized with the adult passage dataset available through the USACE Northwest Division's interactive database query system. At the same time, historical chinook run designations were re-assigned to match current run timings as defined by the USACE and YKFP. Further development of the adult passage count dataset included programming an annual summary report that includes total adult salmon passage counts for all adult species at a selected project for all years in the Columbia River DART database (1938 to the present). The annual summary totals may be limited by a selected range of dates or by chinook run dates as defined by the USACE and YKFP.

Daily updates were made for adult PIT Tag observation histories, mean travel times and conversion rates. The DART adult conversion rate report was expanded to include specific information on overwintering. In response to requests from TMT, additional functionality was added to the conversion rate reports: summary conversion rates for all historic years are reported separately from the current year and conversion rate queries may be limited by a selected month range. Updated adult passage run-timing and run size forecasts were reported through October 28, 2004.

Bonneville Dam Predicted Fall Adult Chinook Run Size

Run Size Prediction on 10/28/2004: 582808
Passage Percent Prediction on 10/28/2004: 99.8%
Preseason Total Run Size Prediction: 237237



At the request of the PUDs, DART continues to obtain the adult passage data for Wells, Rock Island, Rocky Reach and Priest Rapids dams directly from the PUDs to provide web-based data access.

The historical YKFP adult passage data was updated and an ODBC link established to YKFP.org for direct access to current data. This distributed dataset is one of the region's first examples of direct distributed database accesses between fishery organizations. In years where daily counts were not available, the Yakama Nation provided weekly counts with data assigned to an arbitrary day in the week for which counts are available. This is the case for Prosser Dam for the years 1983 to 1991 and for Roza Dam for the years 1986 to 1990. This required additional web programming to integrate historical weekly values into the current DART query system, which is based on daily data.

Columbia Basin ESU

Travel-time and passage information was reported daily for Columbia Basin juvenile and adult ESU populations based on aggregations of the PIT Tag data. Columbia Basin ESU juvenile and adult data services were expanded for migration season 2004 to include: Upper Columbia River Spring Chinook, Middle Columbia River Steelhead, Lower Columbia River Steelhead, and Upper Willamette River Spring Chinook.

Columbia Basin ESU Stocks:

Chinook, Wild, Spring/Summer, Snake River
Chinook, Wild, Spring, Upper Columbia River *
Chinook, Spring Upper Willamette River*
Chinook, Wild, Fall, Snake River
Sockeye, Snake River
Steelhead, Snake River
Steelhead, Upper Columbia River
Steelhead, Middle Columbia River*
Steelhead, Lower Columbia River*

River, Climate and Ocean data

Hydrosystem, climate, upwelling, and ocean buoy data was updated on a daily, weekly, or monthly basis as available and was integrated with the fish passage data.

The Pacific Northwest Index, the region's longest running climactic index, was updated for 2003.

The US Army Corps' oxygen saturation data was loaded daily into the DART database.

Objective 2 – Regional Monitoring, Evaluation, and Data Services

Data Services, Monitoring and Evaluation

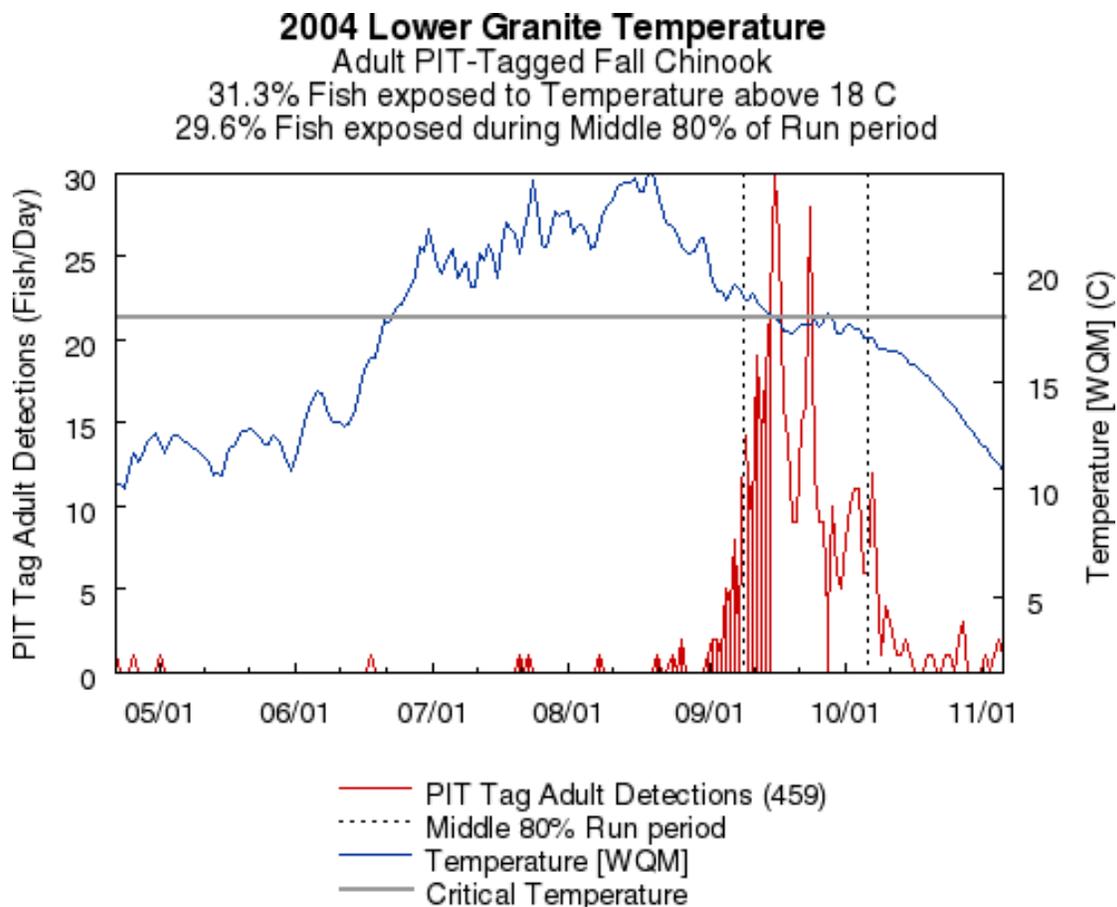
Regional integrated electronic products and services were distributed via the Internet throughout the fiscal year to support BPA and ESA mandated activities. Real time interactive services supported the BPA FWP and the Technical Management Team in adaptive management and recovery efforts.

The integration of hydrosystem, transport operations, fish passage, and climate data provides the basis for modeling of juvenile and adult passage, run size and timing forecasts, and survival and travel time estimates. A new version of the on-line survival estimation program was implemented with continued updates of the PIT Tag detection site configuration for the Columbia Basin.

In support of the data analysis tools and services distributed to the public via the web site, we developed javaDART 2.0, which is a new Columbia River DART database access tool based on the java programming language. We continued to maintain and improve the other DART database access tools including DAT (DART Analysis Tool), which is used to generate Cormack/Jolly-Seber survival estimates and travel time estimates for the PIT Tag dataset.

Columbia Basin Performance Measures

We maintain the online, real-time, data analysis tool generating graphs and summary tables of juvenile or adult fish exposure to hydrosystem conditions (Temperature, Dissolved Gas Percent, Outflow, Spill, Spill Percent, and Turbidity) at the major hydroelectric projects on the Columbia and Snake Rivers. Exposure graphs and summary tables are based on data retrieved from the [Columbia River Data Access in Real Time \(DART\)](#) database. Exposure is based on the total number of fish passing a selected project under user-specified hydrological conditions. Summary tables include statistics for the total run period and the middle 80% of the run period. In addition, we provide Forecasted Exposures based on our Inseason Forecasts for both fish passage and hydrosystem conditions (Dissolved Gas Percent and Temperature). Exposure is based on the forecasted percent of fish passing a selected project under user-specified hydrological conditions. This tool was expanded to include adult count and adult PIT-tag information.



Total Run Period (Apr 22 - Nov 6)	
Total Number of Fish Observed	459
Percent of Total Run Analyzed [Number Observed]	100 % [459]
Temperature Exposure Index	17.71 C
Percent of Fish Exposed [Number Exposed]	31.3 % [144]
Number of Days Fish Exposed	22

[Northwestern Regional Temperature Data Analysis](#)

We continued collection of daily water temperatures for the mainstem of the Columbia and Snake rivers and tributaries from the USGS and US Army Corps.

[PIT Tag Survival and Travel Time Analysis](#)

Survival and travel time analysis and plots for Columbia Basin PIT-tagged hatchery and wild salmon were expanded to include wild releases from Clearwater, Sawtooth and Imnaha traps as well as overwintering stocks. The PIT Tag Survival and Travel Time Analysis data includes: 1) Cormack/Jolly-Seber Survival estimates for Release to Lower Granite, McNary, and John Day as well as single reach estimates (e.g., Lower Granite to Little Goose) and combined reach estimates (e.g., Lower Granite to McNary); 2) Travel Time estimates for Release to Lower Granite, McNary, and John Day as well as Lower Granite to McNary where appropriate; and 3) Detection Probability estimates at various project locations on the Columbia and Snake rivers. Trend statistics features were added to the online analysis, including decadal mean, decadal trend, and smoothed trend. 2004 analyses for Winthrop and Sawtooth Hatcheries were added.

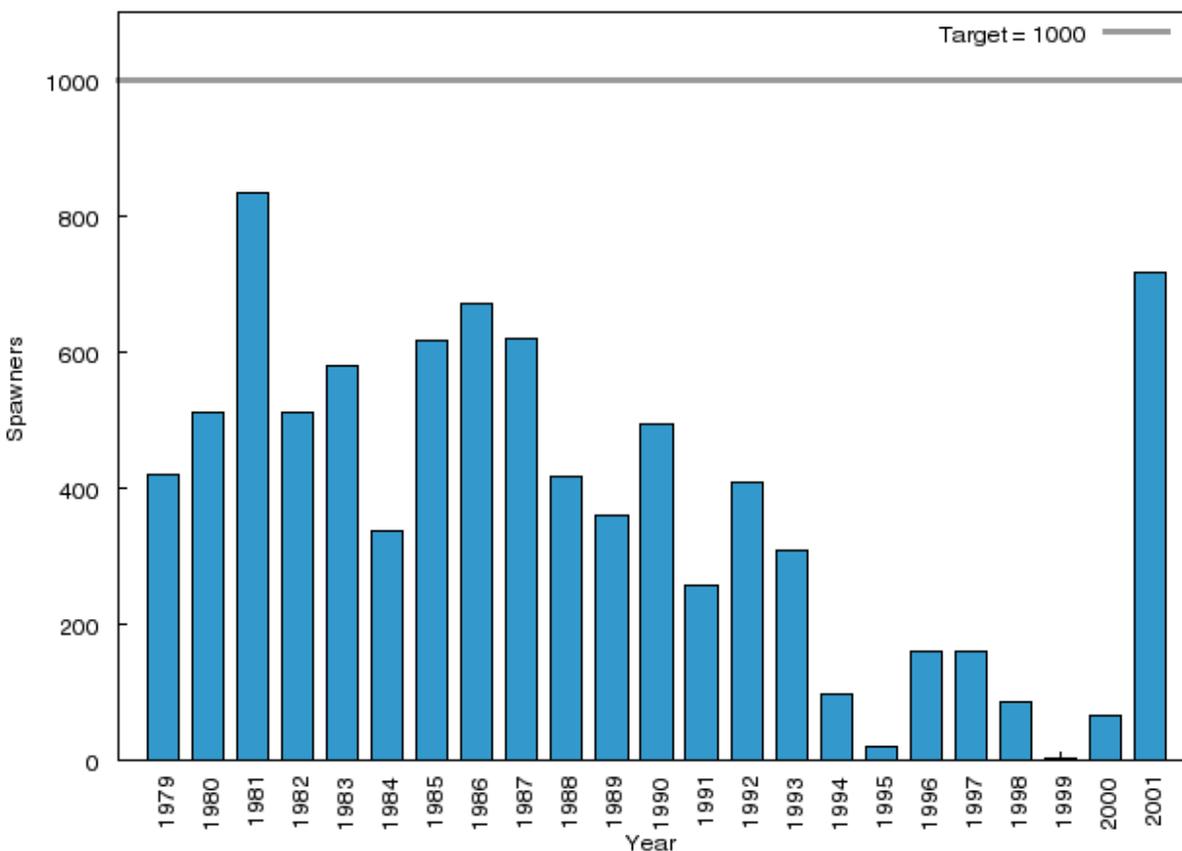
[Smolt-to-Adult Ratio \(SAR\) Estimates for Coded Wire Tag](#)

Online data analysis and plots of SARs for Coded Wire Tag (CWT) hatchery salmon from Oregon, Washington and Idaho were maintained. The analyses were prompted by the need to research, monitor, and evaluate SARs pursuant to the Federal Columbia River Power System 2000 Biological Opinion Reasonable and Prudent Alternative (RPA). The analysis includes CWT returns from 90 hatcheries across the Northwest region for all available years with annual updates of analyses. The CWT release and recovery data analyzed were obtained from the Regional Mark Information System (RMIS). For each hatchery and stock, annual bar charts illustrating SARs are plotted and a table summarizing statistics per tag code is provided. SAR estimates were updated for all analyzed hatchery populations for 1995-2002 CWT recoveries reported in the RMIS database. Trend statistics features were added to the online analysis, including decadal mean, decadal trend, and smoothed trend.

[Adult Escapement for the Columbia Basin](#)

The Adult Escapement for the Columbia Basin web page was created for the purpose of allowing people to compare interim target abundances set by NMFS in their April 2002 memo (<http://www.nwr.noaa.gov/occd/InterimTargets.html>) with historical trend data. Trend statistics features were added to the online analysis, including decadal mean, decadal trend, and smoothed trend.

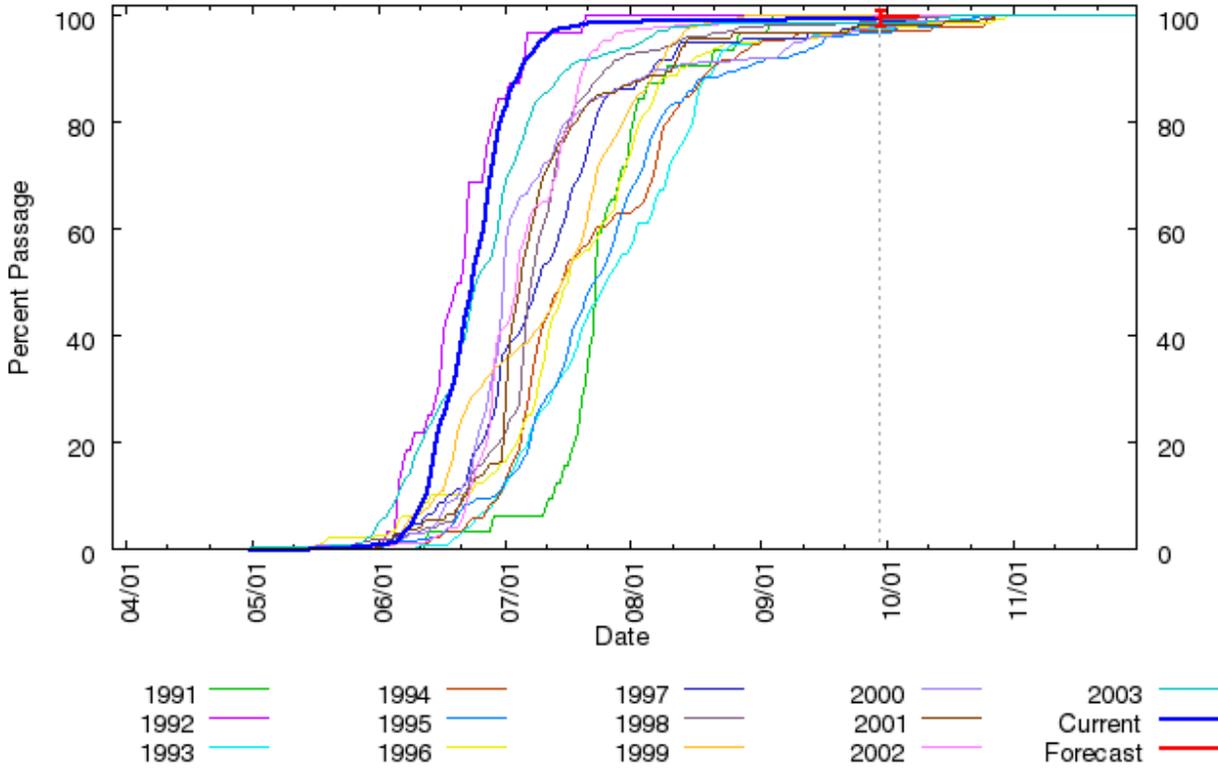
Adult Escapement Tucannon River Spring/Summer Chinook



[Inseason Forecasts](#)

The Inseason Forecasts tool uses "real time" information about the current status of various Columbia Basin juvenile and adult salmon runs along with current hydrographic information to predict the future progress of the migrating fish. We produced daily run-timing, transport, and survival predictions for juvenile yearling chinook, subyearling chinook, and steelhead stocks from the Snake River basin; daily run-timing and survival predictions for juvenile Columbia Basin ESU populations; daily run-size and run-timing predictions for adult spring chinook and fall chinook; and daily forecasts of total dissolved gas and temperature at multiple locations throughout the Columbia Basin. This tool has the potential to allow real time river management with respect to endangered populations.

Lower Granite Dam
 Percent Passage for Wild Trapped Subyearling Chinook
 Data thru 9/30/2004
 Current Prediction: 100% +/- 1%



Name of Run	Latest Date	Pred Pct	95 CI (Pct)	Days Error	Day of Run	Num Fish Detected	Adj Fish Detected	Num Fish Released			
SNAKER	09/30/04	99.9	1.4	4.3	152	1786	1809.8	5534			
Percent: SD(Day)	5% 0.0	10% 0.0	20% 0.0	30% 0.0	40% 0.0	50% 0.0	60% 0.0	70% 0.0	80% 0.0	90% 0.1	95% 0.2

Adult Fallback Analysis

DART provided data services, programming and web logistics to present the USACE's requested Bonneville daily and cumulated fallback analysis.

Site	First Date	Last Date	Unique Fish	Total Ascents	Proportion Unique	Fallback Rate	SE
BO1	04-Mar-2004	08-Sep-2004	1447	1467	0.9864	0.0136	0.0030
BO2	08-Mar-2004	30-Aug-2004	641	647	0.9907	0.0093	0.0038
BO3	11-Mar-2004	01-Oct-2004	1408	1442	0.9764	0.0236	0.0040

javaDART Applet

javaDART 2.0 is a new Columbia River DART database access tool based on the java programming language. It runs within a web page as an applet giving users greater flexibility to extract and analyze data from DART in both graphical and text-based formats. javaDART provides access to the River Environment, Adult Passage, and Juvenile Passage data sets. Plotting multiple data types in a single graph is possible with javaDART, which supports up to four separate Y axes. Graphs can be configured with axis scaling options including zoom in and zoom out capabilities for each axis as well as a round axis function that uses an adaptive rounding algorithm to create readable axis value labels. Graphs may be saved or exported to number of popular formats or copied to the system clipboard. With the text data interface, users can specify which columns to be copied or saved to disk. The text view handles both Julian dates and a standard date format. javaDART data analysis functions include parameter versus parameter (XY) plots and linear regressions on data series pairs. Regression lines and statistics are displayed on the graphs. Data filtering algorithms are a powerful data analysis feature of javaDART that can identify and remove erroneous data that sometimes occur in data queries. The user can easily control the amount of filtering using a redesigned filtering interface with slider controls. In addition, javaDART offers data accumulation; histogram options by weeks, months, or years; and plotting multiple years consecutively or as individual years.

Data Analysis Services for Modeling, Monitoring, and Evaluation

In-house support was provided to Dr. John Skalski's and Dr. James Anderson's groups. This included providing additional PTAGIS observation data for survival and travel-time analysis and adult passage data for continued adult passage modeling and fallback analysis. The integration of adult escapement data with existing data sets continued.

By request, DART provided specific data analysis services to: Idaho Department of Fish and Game, USACE, University of Idaho, WDFW, NOAA, Pacific Institute for the Mathematical Sciences, Virginia Institute of Marine Science, Connell High School, USGS, Idaho Power, Fish Passage Center, Carollo Engineers, Seattle City Light, Nez Perce, DCPUD, CCPUD, GCPUD, PNL, NPPC, John R. Stevenson-Fisheries Biologist, British Petroleum, Lands Energy Consulting, PNGC Power, Farmington High School, Hampton Affiliates, EVS Environment, Mobrاند, KWA Ecological Sciences Inc., Grand Valley State University, ODFW, Colville Tribes, Washington State Department of Ecology, Portland State University, and Eastern Oregon University.

Objective 3 - Database Administration and Base Support Services

Database management and administration

Normal DART maintenance was conducted throughout the contract year. Data loads were monitored and reviewed on a daily basis. Performance tuning, indexing rebuilds and daily monitoring of incoming web user database access continued. Weekly updates were made to data specifications. Weekly year-to-date updates were performed to synchronize datasets with primary sources.

Frequent contacts were made with PSMFC, U.S. Army Corps of Engineers, Grant County PUD, Chelan County PUD, Douglas County PUD, USFWS, USGS, NOAA, NWS, NCDC, YKFP, and Fish Passage Center to synchronize data from 2004 and to report and correct data anomalies. Data availability, data file format, and meta-data issues were addressed through feedback with the primary sources.

Planning for the 2004 calendar year roll-over was developed and implemented. This included a 2004 update to javaDART, the java-based DART graphics query tool.

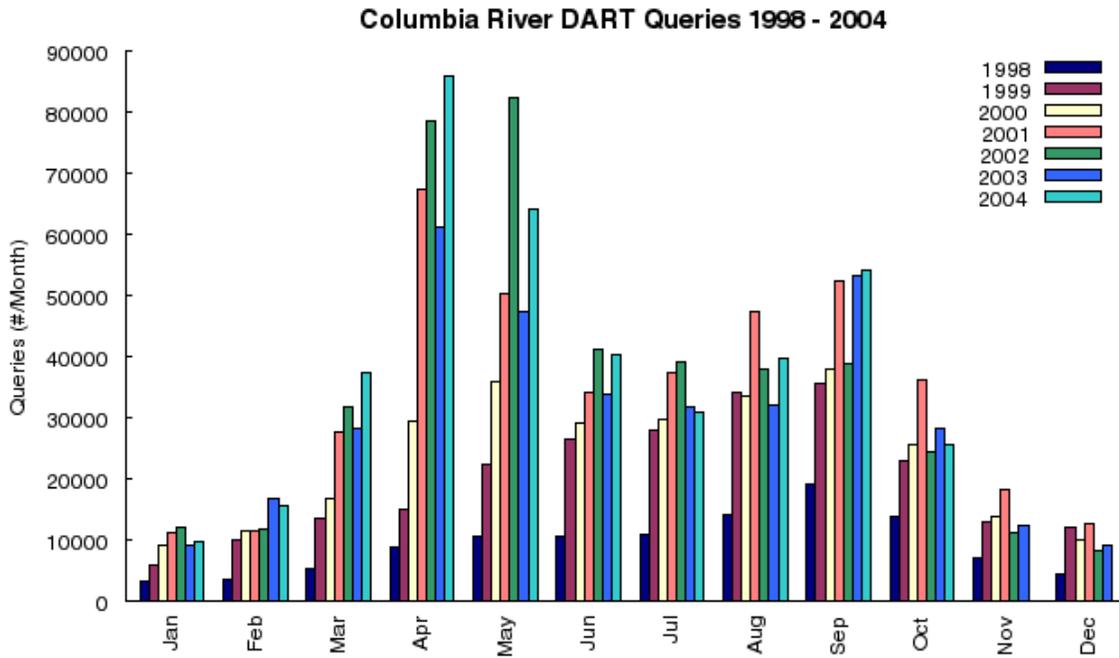
Data and meta-data requests from the public were filled as they were received. Issues with primary data raised by users were resolved. Reports and database objects were modified to accommodate user requests when appropriate.

System Administration

We administered, managed, and maintained the Sun Ultra 450 Enterprise Server which houses the INGRES database management system and the Columbia Basin Research web server and all related files systems. Normal system administration activities included: monitoring network security, installing the official Sun operation system patch cluster, and maintaining database mirroring and file system backups. In addition to these activities, we upgraded the Apache web server software to expand scripting functionality to include PHP; we had the network router upgraded to improve internal and external connectivity performance; and we relocated data from two failed disks on the Sun Ultra 450 Enterprise Server.

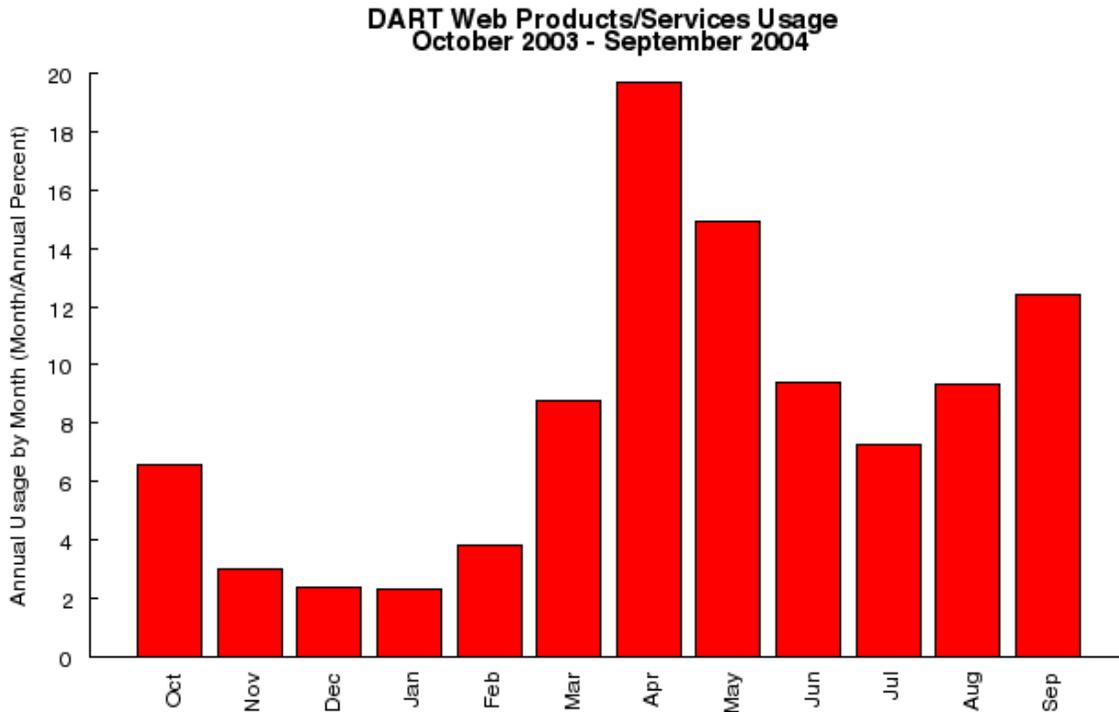
DART Evaluation

We collected individual DART user actions and patterns to illustrate the use and usefulness of DART to the region planners and policy makers. We make the monthly usage of the DART query system available to the public on the DART web site.



Each quarter, we analyzed individual user actions with respect to user tendencies and affiliations with data gathered from the website logs and emails. We produced a summary report on user affiliations and utilization of all DART services for each quarter.

We reviewed and assessed the annual usage of the DART query system and DART web products and services. Based on this review and the continuous evaluation of requests from users, we will devise and implement future modifications and improvements to the DART services.



DART Web Products/Services Usage October 2003 – September 2004

DART Product/Service	Accesses	Selected Users of Note (# of Accesses)
DART Query System	393298	EDU(10821),NOAA(7420),WDFW(8938), State of Idaho(10233), PNNL(6946), USGS(3060) Idaho Power(3879), USACE(4054), BLM(2335), DOE-Hanford(5201), BPA(3768), CRITFC(1433), USDA(3326), WSDOE(973), GCPUD(241), State of Oregon(3602), Nez Perce(3584), DOD(1295), USFS(677), USFWS(1479), Washington Public Schools(1561), NIH(502), USBR(654), NPPC(524), CCPUD(1186), INEL(483), WS Legislature(37), ANL(574), EPA(294), Almaden Research Center (227),DCPUD(632), DOI(62), Biomark(56)
Sport Fishing & Recreation	35080	EDU(619), USBR (583), PNNL(374), DOE-Hanford(209), State of Idaho(206), USFS(169), BPA(111)
CWT Smolt-to-Adult Ratio (SAR)	2664	WDFW(407), NOAA(365), BPA(90), EDU(44), USACE(39), PNL(29), CCPUD(22), Mobrand(16), CRITFC(16), Nez Perce(12), GCPUD(12), State of Idaho(11), USBR(10), Canadian Government(8), Idaho Power (7), BLM(5),State of Oregon(2)
Inseason Forecasts	8741	NOAA(539), CCPUD(818) PNNL(260), EDU(216), USGS(172), USACE(148), BPA(117), State of Oregon(86)), State of Idaho(19), WDFW(199), DOE-Hanford(9), CRITFC(44), Nez Perce(28), USDA(25), USFWS(23), DCPUD(80),GCPUD(121), DOE-Hanford(15), NIH(12),
Performance Measures	195	EDU(18), USACE(15), NOAA(6)
PIT Tag Survival	457	EDU(42), Nez Perce(35), NOAA(29), BPA(8), PNNL(9), State of Idaho(7), USACE(7), GCPUD(4), WDFW(4), USGS(3), USDA(2)
PNI Climate Measure	927	EDU(127), NOAA(12), WDFW(6), ,USACE(3), PNNL(2), NASA(2)USACE(3), OSU(2), UO(2), USDA(2)
DAT CJS Survival/Travel Time	335	EDU(71), Idaho Power(71), USACE(50), NOAA(23), State of Idaho(5), USFWS(3), PNL(3), WDFW(3), Nez Perce(2), USGS(2),
Adult Escapement	817	NOAA(129), WDFW(32), PNL(29),USDA((9), USACE(9), DCOUD(7), State of Idaho(6),
javaDART Applet	833	EDU(138), PNL(58), BPA(8), USGS(7), BLM(2),
Mid-Columbia Status	223	WDFW(19), NOAA(18), USFW(2) CCPUD(1)
NW Council Reports	5416	NWPC(5401)