Response for: PROJECT ID 199601900
Second Tier Database Support
Date: August, 23 2002

ISRP COMMENT "*The response should provide specific tasks and detailed methods to accomplish each objective.*"

f. Proposal objectives, tasks, and methods

Four Dart Objectives are identified

1) Maintain the existing DART system providing web-based real-time and historical data integration services and analyses needed by FWP and ESA modeling, monitoring and evaluation efforts. The current level of DART development also contributes to the primary objectives of the RM&E component of the Draft Endangered Species Act Implementation Plan. DART provides real-time integrated access to the status of adult and juvenile mainstem migrants and their environment, including information on the physical (hydrosystem conditions) and biological (reach-specific travel time and survival estimates, migrant exposure to environmental parameter extremes) responses to management actions in historical and real-time.

- Data acquisition and Quality Assurance. Over 400,000 rows of data are obtained via ftp and http file transfers, web-based data queries, and email for loading each day.

  - Obtain and parse data from:
    FPC,
    PSMFC,
    USGS,
    USACE,
    Grant Count PUD,
    Chelan County PUD,
    Douglas County PUD,
    Sno-Tel,
    National Weather Service,
    National Climate Data Center,
    Pacific Fisheries Environmental Laboratory,
    US Bureau of Reclamation.

  - Provide data quality feedback and correction requests to primary data sources.
  - Document data sources and associated meta data.

- Database management and administration of the 93 million row INGRES database running on a Sun Ultra 450 Enterprise server.

- Monitor & mange disk & CPU resources.
- Manage DB objects.
- Manage user access.
- Monitor daily data loads.
- DB and query performance tuning.
- Monitor locking to optimize concurrency and access.
- Maintain backup & recovery plans to ensure system availability.
- Synchronize DART with primary data sources using periodic YTD and historical updates.

- Programming data retrieval, analysis and delivery to web users.

  - GUI and HTML updates and programming
  - C/C++ updates and programming
  - SQL and INGRES Report Writer updates and programming
  - Maintain on-line user help and technical background information
  - Maintain JavaDart: a java code direct database access query and analysis tool.

- System Administration

  - Operating system maintenance and security.

2) Maintain and expand the real-time tools providing current and predicted run-timing information on specific stocks, including ESUs and adult migrants as well as water quality in the power corridor. DART's in-season forecast modeling provides valuable information for the timing of flow, spill, and temperature mitigation efforts that can address the priorities of generating immediate habitat benefit

- Maintain and update migration model parameter inputs using up-to-date data on hydrosystem conditions, PIT-tagged fish migration rates and available survival estimates.

- Develop hydrosystem description files for historical and current years using observed data and BPA projected flow and spill information.

- Calibrate stock-specific migration and predation parameters.

- Calibrate dissolved gas model parameters to take into account hydrosystem changes affecting gas generation.

- Develop models to include additional water quality measures.

- Report daily real-time migrant arrival data at the upstream sites as a basis for model runs and estimate cumulative passage percents.

- Generate and report passage and water-quality predictions for downstream projects.

- Provide post-season analysis on the accuracy of in-season predictions.

3) Continue the development of user-friendly, timely reporting and analysis tools to provide information on the status and effectiveness of performance measures. DART has always been in continuous development. As the need for data services are identified by users, the DART team develops integrated solutions and products to meet those needs. The DART team receives requests from a variety of sources; the majority of requests come from agencies and groups directly involved with hydrosystem management such as Technical Management Team (TMT), the Research, Monitoring and Evaluation Group (RME), BPA, and NMFS. Specific tasks identified at this time include the following:

- Improvement of user-specified stock survival and travel time including the expansion of estimates to include ocean survival, and adult travel times. These estimates are available through www.cbr.washington.edu/dart/pit_sum_isab.html.

- Further development of the environmental parameter exposure measures analysis for specific stocks, available at www.cbr.washington.edu/perform/.

- Further development of data analysis and plots of SARs for CWT hatchery salmon from Oregon, Washington and Idaho. Information will include wild releases and allow user to select grouping criteria. See the prototype system at www.cbr.washington.edu/cwtSAR/.

- Further develop the adult passage in-season forecasts, including confidence limits on passage predictions. See www.cbr.washington.edu/crisprt/index_adult.html.

- Develop stock specific hydrosystem conversion efficiencies for adult upstream migration based on information from the adult PIT-tag detectors.

- Develop a Cormack/Jolly-Seber reach-specific survival estimate data set for specific hatchery and wild release groups.

- Integrate survival and travel–time estimates with performance measures as defined by the RME group.

- Develop disease analysis tools as a compliment to CBR research that hypothesizes that hydrosystem passage temperature affects BKD related delayed mortality. The tool will predict when to transport smolts according to the river temperature and will predict the ratio of transport and in-river passing fish SARs as dependent on passage temperature.

4) Participate in regional planning and development of an integrated database. As a second tier data repository, CBR's DART group has extensive experience integrating data from varied sources, providing public access, adapting to user requests, and developing relevant reporting and analysis tools. We propose to:

- Continue working with, and exploring, the potential of XML and related database access tools in a distributed database environment.

- Enhance JavaDart to provide access to multiple databases, providing a prototype reporting and analysis application for access to distributed databases.

ISRP COMMENT "*Also, the project must have a monitoring and evaluation plan, including for example, lists of services provided.*"

Monitoring and evaluation plan:

As a project, DART addresses the RM&E component of the Draft Endangered Species Act Implementation Plan. It currently provides public access to user-defined reports and analyses of the Columbia Basin's environmental and ecological data integrated from multiple sources in real-time. As such, it provides a number of the features desirable in a region-wide integrated database indicated as part of the overall strategy for recovery. DART has pioneered the reporting of rigorous, and repeatable, user-defined juvenile salmonid survival estimates, travel times, and environmental exposures as performance measures. It allows the real-time monitoring of mainstem compliance to the BiOp. It currently provides the most comprehensive reporting and analyses on PIT-tagged salmonids representing the regions ESUs.

DART's performance should be evaluated on the basis of delivered data products and their usefulness to the regions efforts. As an information system, DART provides daily access statistics available at www.cbr.washington.edu/access/biz/index.html. These statistics can identify user associations to federal, regional, and local agencies associated with the recovery plan. DART also provides monthly summaries of database queries generated by users at www.cbr.washington.edu/dart/dartstats.html. The user statistics illustrate the DART is growing in value to the region as a basin-wide monitoring and management tool. We expect over one-half million queries to the DART database for 2002.
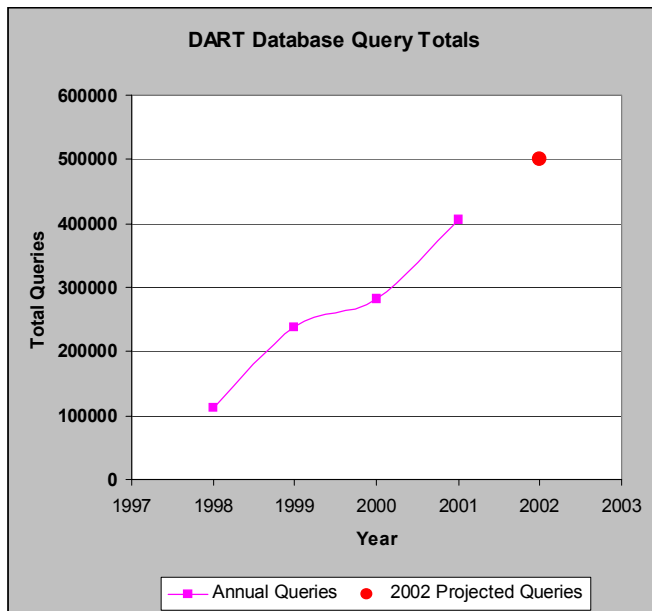

Figure 1. The annual totals of delivered database reports for the past four years with a projection for this year.

A number of DART's tools report predictions of adult or juvenile passage, water quality and transport. These tools can be evaluated on the correspondence of predictions to observed data. Each year, DART provides an on-line, post-season analysis of the accuracy of these predictions.
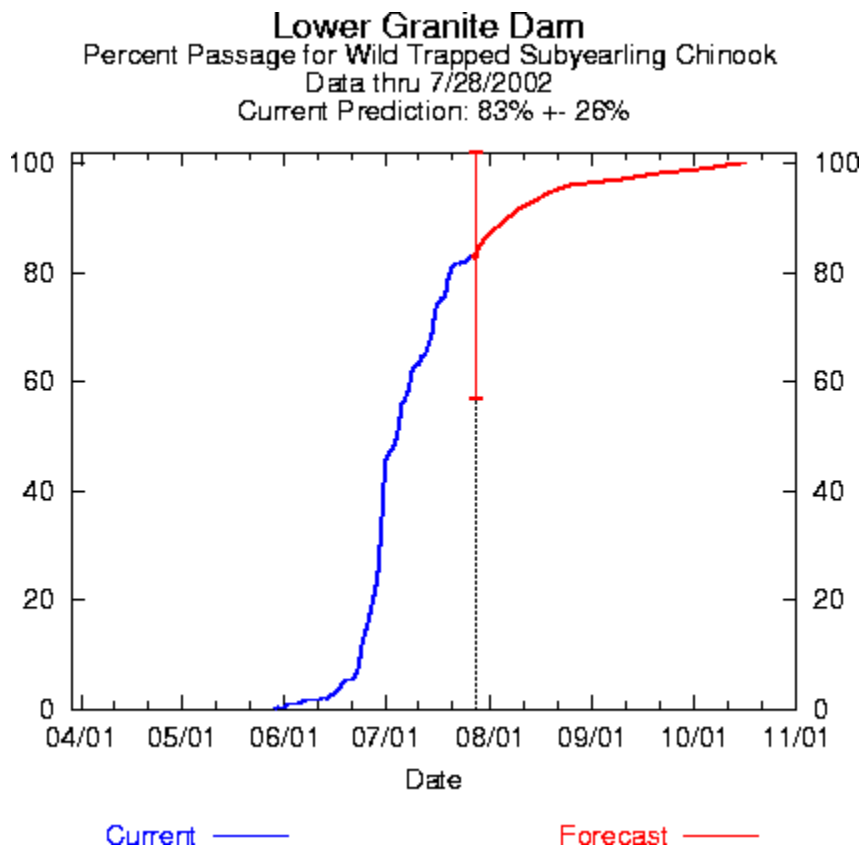
Services List:

- *Standard DART tools*: The DART database has a variety of data extraction and graphing tools that allow web users to query data by location and time plot data. These have been in use seven years and are frequently used by web users to track the status of adult and juvenile fish runs relative to the river conditions in the Columbia / Snake River system.
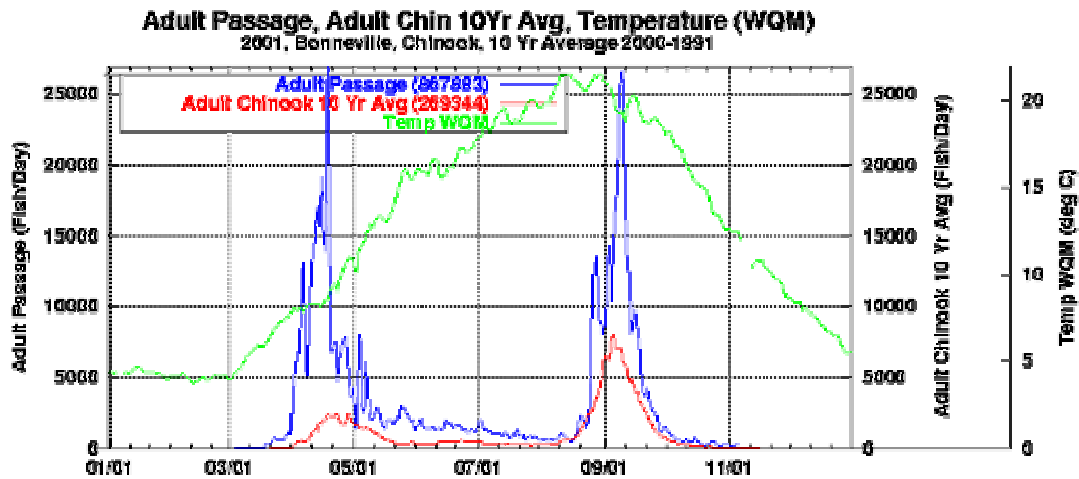
- *PIT-tagged release and observation summary report*: This tool allows users to summarize the release data and subsequent observation histories of user-selected stocks. Requested by the ISAB, this tool permits users to determine when and where salmonids are being PIT-tagged, released, and subsequently observed. This tool provides the starting point for subsequent travel-time and survival estimation.

- *Travel Time analysis*: This new DART tool allows users to generate the mean travel time of pit-tagged fish based on the selection criteria in the Release and Observation summary report. Mean travel time estimates can be generated for PIT-tag groups as defined by user selections for species, run, rear-type, release year, tag coordinator, release location, detection year, and detection site.

- *Survival analysis*: This DART tool allows users to generate Cormack/Jolly-Seber estimates of the reach specific survival fractions of pit-tagged fish based on the selection criteria in the Release and Observation summary report. Survival estimates can be generated for PIT-tag groups as defined by user selections for species, run, rear-type, release year, tag coordinator, release location, detection year, and detection site.

- *10 year averages*: DART automatically calculates the 10 year averages for adult passage, outflow, spill, temperature, elevation, and dissolved gas percent.
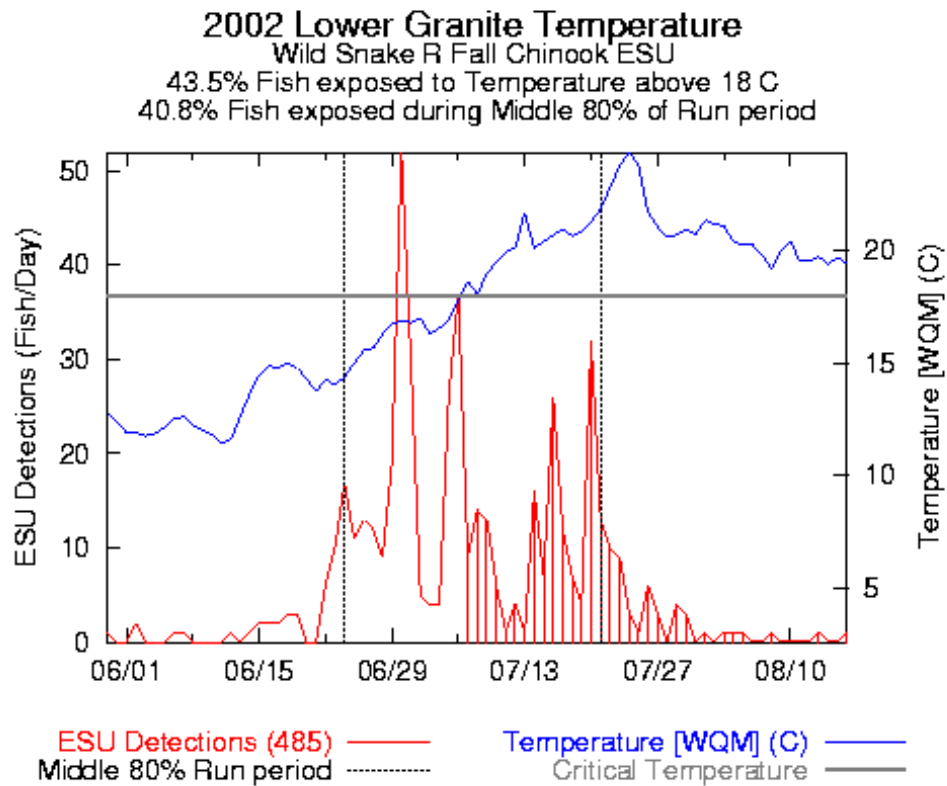
- *Endangered Species Data*: This DART suite of tools provides information about ESU populations as defined by NMFS and based on PIT-tagged fish. The ESU report and analysis tools include: detailed detection histories, graphical and tabular detection summaries, mean travel time estimates, and in-season run predictions presented in graphical form. The performance measures pages present project-specific ESU exposures to user defined parameter extremes.

- *Real-Time Passage Predictions*: Predictive models of in-season adult and juvenile migrant passage, transport totals, and water quality presented in a graphical format. Below is an example of passage predictions for wild subyearling Chinook made on July 29th, 2002.

Lower Granite Dam
Percent Passage for Wild Trapped Subyearling Chinook
Data thru 7/28/2002
Current Prediction: 83% +- 26%

- *Ocean Conditions*: Graphical and tabular presentations of near shore ocean conditions including buoy data and PFEL's upwelling and cross-shore transport indices.

- *Climate*: Graphical and tabular presentations of climate data from numerous stations throughout the region as well as annual updates of the Pacific Northwest Index (PNI)

- *Northwestern Regional Temperature Data Analysis*: A specialized analysis within DART derives seasonal stream temperature profiles using primary data from the EPA STORET and StreamNet databases. Algorithms fit the temperatures with three and six parameter algorithms to generate complete seasonal profiles for hundreds of streams in the NW. Temperature profiles for

NW regional streams are developed in a systematic manner and applied to fish presence. Daily water temperatures for the mainstem of the Columbia and Snake rivers are used directly where daily fish distributions are also known. Annual temperature profile parameters are related to surveyed presence / absence information for other streams and temperature compliance in streams is illustrated with spatial temporal mapping tools.

- *Exposure Analysis*: This service, available for spring 2002, integrates river flow, temperature, and total dissolved gas distributions with fish distributions to provide a real-time spatially explicit picture of the exposure of juvenile and adult salmon to water quality properties. The analysis includes tools for synthesizing environmental and biological data. Below is an example of Snake River Fall ESU exposures to temperature in the Lower Granite Project.

2002 Lower Granite Temperature
Wild Snake R Fall Chinook ESU
43.5% Fish exposed to Temperature above 18 C
40.8% Fish exposed during Middle 80% of Run period

ESU Detections (485) ——
Middle 80% Run period -----------
Temperature [WQM] (C) ——
Critical Temperature ——

EXPOSURE SUMMARY

Year	2002
Project	Lower Granite
River Parameter	Temperature
Critical Temperature Value	18 C (user set value)
Total Run (May 30 - Aug 16)	
Total Number of Fish	485
Temperature Exposure Index	18.19 C
Total Percent Fish Exposed	43.5 %
Total Number of Fish Exposed	211
Number of Days Fish Exposed	30
Middle 80% of Run period (Jun 24 - Jul 21)	
Number of Fish	404
Temperature Exposure Index	18.1 C
Percent Fish Exposed	40.8 %
Number of Fish Exposed	165
Number of Days Fish Exposed	15
Run Dates	
First Day of Run	May 30
10% of Run passed	Jun 24
50% of Run passed	Jul 6
90% of Run passed	Jul 21
Last Day of Run	Aug 16
Date(s) When Temperature Crosses 18 C Line	

Jul 7

CWT SAR Analysis: This service, prototyped in summer 2002, presents the currently available CWT recovery data from Washington, Oregon and Idaho hatcheries presented as brood-year SARs.

Spring Chinook / Rapid River Hatchery
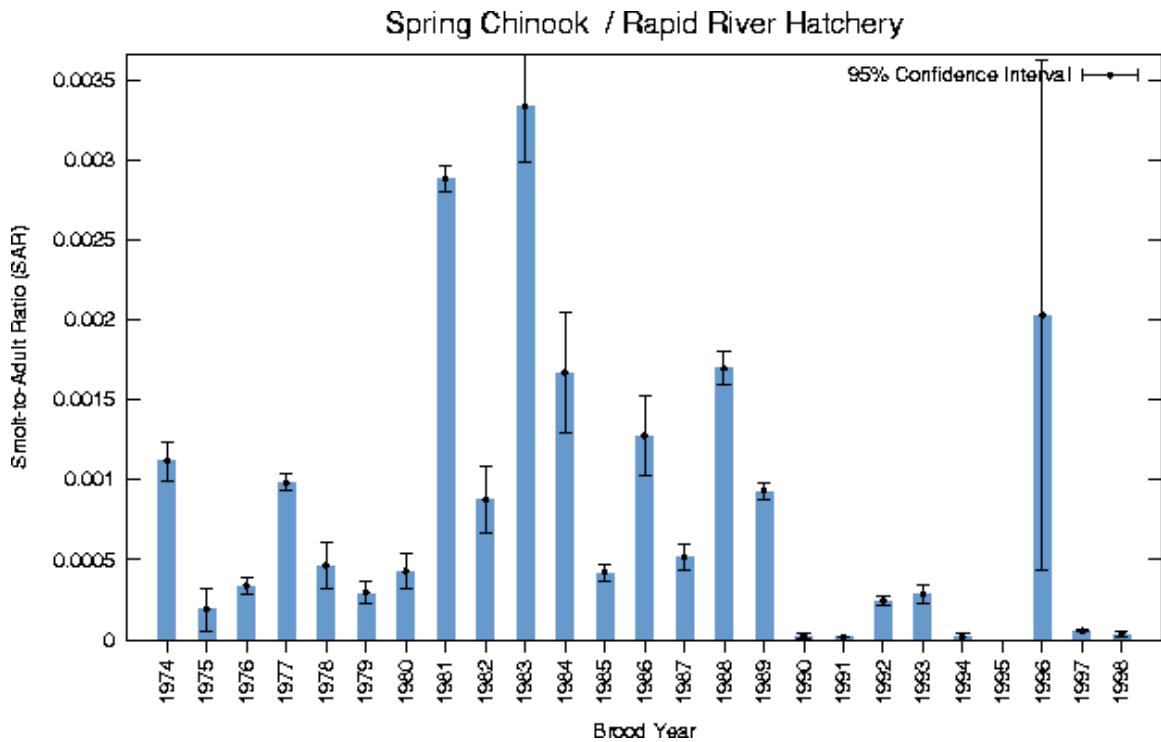
ISRP COMMENT "*Only 4 objectives are identified, but in the text, it is stated that an FTE is needed for objective 5. Please clarify*."

Original>   Continuing with Objectives 1) and 2) will require current support with a
Original>   5% yearly increase to cover increasing costs and continued replacement of
Original>   aging equipment. Objectives 3) and 4) together require an additional FTE.
Original>   Objective 5) requires an FTE as well as additional support from other
Original>   agencies.

This paragraph should read:

The Objectives 1 through 4 represent a continuation of the previous level of DART activity involving maintenance of the computer system and databases, plus refinement and limited new development of analysis tools. The projection includes a 5% yearly increase to cover increasing costs and continued replacement of aging equipment. If the Council or the Federal Agencies requests that DART assume a greater role in data analysis and regional database coordination then we are eager to assist; however, any significant expansion will require additional staff.

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RM&E COMMENT "*The DART proposal is not considered a core contribution to a basin-wide hierarchical monitoring program (Action 180) and appears to be more closely directed to reporting and tracking the effect of temperature, flow and gas changes on populations and passage.*"

We disagree with the comment that DART is not a core contributor to the monitoring program. While DART is not in the realm of data collection, DART provides real-time access to reported data that is an essential component of performance measure monitoring and response planning. DART has repeatedly demonstrated how scientific databases combined with powerful analysis applications can provide immediate access to stock status and the effectiveness of management actions. DART currently provides products that address all 5 levels monitoring identified in the RM&E strategy. DART has pioneered the reporting of rigorous, and repeatable survival estimates, travel times, and environmental exposures as performance measures. These analyses are currently on-line and available to the public with further development and product enhancement planned. DART allows the real-time monitoring of mainstem compliance to the BiOp power corridor management conditions. It currently provides the most comprehensive reporting and analyses on PIT-tagged salmonids representing the regions ESUs.

RM&E COMMENT "*Apart from indicating general support and suggesting actions that should take place (Action 198), DART does not propose any particular actions.*"

DART was originally conceived and implemented to provide the type of data integration called for in the Draft Endangered Species Act Implementation Plan. As such, it has encountered and resolved many of the issues that face the development and implementation of a regionally distributed database addressing the needs of the region. It has provided continuous access to the region's data and analyses to the public since 1995. As outlined in the expanded **Section f** above, we propose limited further development of JavaDART into a prototype distributed database application. In addition, we will continue to explore emerging standards and technologies such as XML and .NET, which are the tools upon which the IT industry is developing its distributed database strategies. We specifically do not propose any major database actions and believe our immediate contribution is best made by improving incrementally our existing tools and contributing to the regional discussion.

DART's Process Diagram illustrating its niche as an integrator of databases.