SCOPE OF WORK

FOR THE

AYK SALMON DATABASE MANAGEMENT SYSTEM

By:

Linda K. Brannian,
Seth Darr,
Holly A. Moore,
And
Shane StClair

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Alaska Department of Fish and Game
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Arctic-Yukon-Kuskokwim Region
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AUTHORS

Linda Brannian is a Regional Research Supervisor for the Alaska Department of Fish and Game, Division of Commercial Fisheries, 333 Raspberry Road, Anchorage, AK 99518.

Seth Darr is an Analyst Programmer for the Alaska Department of Fish and Game, Division of Commercial Fisheries, 333 Raspberry Road, Anchorage, AK 99518.

Holly Moore is an Analyst Programmer for the Alaska Department of Fish and Game, Division of Commercial Fisheries, 333 Raspberry Road, Anchorage, AK 99518.

Shane StClair is a Research Analyst for the Alaska Department of Fish and Game, Division of Commercial Fisheries, 333 Raspberry Road, Anchorage, AK 99518.

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OEO/ADA STATEMENT

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

ABSTRACT

The Alaska Department of Fish and Game, Division of Commercial Fisheries, Arctic Yukon Kuskokwim (AYK) Region is creating a salmon database management system (DBMS). The goal of the database is to provide managers, researchers, and the public involved in salmon fisheries in the AYK Region with a system to enter and process new data, as well as to retrieve historical data. By June 30, 2007 the AYK salmon DBMS will allow users to store, modify, and extract AYK project listing data, biological measurements of age, sex, and length, escapement data, and Norton Sound test fisheries data through an Internet site. Similar access to tagging and the remaining AYK test fisheries data is projected for completion by 2009. Extraction and reporting through the Internet of subsistence and commercial harvest data will be completed for Norton Sound by June 30, 2007 and expanded to include the rest of AYK by 2009. This document serves as a scope of work for the AYK salmon database management system and delineates components funded by U.S. Fish and Wildlife Service, the Norton Sound Salmon Research and Restoration Fund, and State of Alaska general funds. The scope of work spans five years (July 1, 2004- July 30, 2009), describes components to be included, hardware and software requirements, personnel, and time line for completion. Future projects and the need for additional funding for the last two years of the plan (2008 and 2009) are also included.

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INTRODUCTION

Effectiveness of fishery management is enhanced when full use is made of existing information. Timely access to critical information from many sources is needed to make informed decisions. Furthermore, increasing participation by public entities and federal agencies in both data collection and fishery management decision-making makes imperative all parties have access to the same information. Funds were provided by the U.S. Fish and Wildlife Service (USFWS) Office of Subsistence Management (OSM), and the Alaska Department of Fish and Game (ADF&G) general funds and other federal grants, specifically the Norton Sound Salmon Research and Restoration fund, for the Arctic-Yukon-Kuskokwim (AYK) Region of ADF&G to create a database management system in which all data will be centralized, have a standard format, and be shared among management agencies and the general public.

AYK Region salmon fisheries are managed by both state (all uses) and Federal staff (federally qualified subsistence users only). This region encompasses over 70% of the landmass in Alaska (Figure 1) and includes Norton Sound, Kotzebue Sound, Port Clarence, and the Yukon and Kuskokwim Rivers. It is characterized by a diversity of commercial, subsistence, sport, and personal-use fisheries harvesting freshwater, anadromous, and marine fish species. ADF&G, Division of Commercial Fisheries (CF) has divided the region into four areas for salmon management purposes: (1) the Kuskokwim, (2) the Yukon, (3) the Norton Sound/Port Clarence and (4) the Kotzebue Sound areas.

Data are collected annually to support fishery management decision-making and data management is specific to particular areas within the region. Paper records and computer spreadsheets are most commonly used, making it difficult to share information among areas or respond to specialized requests. Existing data summaries often lack the ability to display and summarize data in alternate ways. Various types of related data stored in many formats and locations (ADF&G area offices in Nome, Bethel or Fairbanks and seasonally in Emmonak and Kotzebue) make questions requiring integration of multiple data sources difficult to answer. In addition, the dangers of losing data during staff turnover and degradation in electronic media are a concern.

This report describes the overall scope for development of a salmon database management system for the AYK Region: software-hardware components, timeline for completion, and personnel assignments. The report includes: 1) an overview of all funding sources used thus far to develop the AYK salmon database management system, 2) the data components and level of access to be included, 3) the relationship of intermediate databases and the final central database, and 4) plans for data standardization. A 5-year plan, the scope of work encompasses activities through June 30, 2007 and suggests projects through 2009.

Project Background and Funding Sources

Recognizing the need to develop a mechanism to standardize the collection, storage, and analysis

of fisheries information in January 2000 (Figure 2), ADF&G AYK staff proposed a 5-year, $300,000 project to create a salmon database management system for AYK to USFWS OSM. This proposal was rejected because of its cost and duration, and instead a one year $60,000 pilot project (FIS 00-016) was funded. The specific objectives of project FIS 00-016 were to (1) create an inventory of existing salmon data sources, and, (2) to conduct a preliminary needs-assessment survey of fisheries managers and researchers in the AYK Region. As part of this effort, historical and current AYK salmon projects were described and primary contact information (agency, project leader, etc.) was included (Hamner et al. 2002). An inventory of project-associated data was created to include electronic filename, file type, project type, location, species, and data descriptions. As part of the project a summary of the results of an informal survey of state and federal fisheries management and research staff, was included. This summary identified data sets and data summaries required to make more informed fishery management decisions. First steps in creating a database of historical and current salmon data were the inventory and survey. In the early stages of the project it became apparent that a thorough inventory could not be completed within the allotted timeframe and funding, mostly because of the discovery of large quantities of disorganized data.

Supplemental funding was sought to assist in continuing work on the salmon database management system for AYK. Sources included OSM, federal disaster relief funds appropriated for the purpose of restoration and rehabilitation of Norton Sound salmon populations, National Oceanic and Atmospheric Administration (NOAA), and the AYK Sustainable Salmon Initiative (AYK SSI) representing a portion of the federally appropriated Pacific Salmon Recovery fund. Two OSM proposals were approved for funding. Project FIS 02-069 for the period March 15, 2002 through January 31, 2003 was used to continue organizing historical data (Hamner et al. 2003a) and project FIS 04-701 for the period July 1, 2004 through June 30, 2007 will be used to fulfill objectives described in this scope of work.

The Steering Committee for the Norton Sound Salmon Research and Restoration (NSSRR) fund approved a five-year project (July 1, 2002 through June 30, 2007) for the development of a Norton Sound Salmon Information database (Hamner et al. 2003b). In the first year of the project, a data inventory was updated (see overlap with FIS 00-016 in Figures 2 and 3) and completed for the Norton Sound area. Additional ASL electronic files for Norton Sound salmon were aggregated and transferred to modern storage media. In this second year, ASL data not found as electronic files were reentered from handwritten forms into the ASL database. Although these funds are allocated specifically for Norton Sound, applications and database structures developed for the Norton Sound Area are useful in other areas of the region since data collection follows a standard protocol across the region.

Additional funding was requested after discovering a significant number of ASL electronic files had been lost by changes in staff and degradation in aging electronic media. In response, the NOAA funded a concurrent project to transfer data in obsolete media to current systems and aggregate, standardize, correct and load chum salmon ASL data for the Kuskokwim, Norton Sound, and Kotzebue areas into a database (Hamner et al. 2004). A similar proposal focusing on species and areas not covered by the other funding sources was funded by AYK SSI (StClair and Hamner 2004).

The work involved in inventorying, rescuing, editing, and loading data into databases exceeded the amount of funding available from any one source. Combined funding was sufficient to continue the development of an AYK salmon database management system. Projects through time shared many overall objectives (Figure 2), but differed in duration or specific focus (i.e. specific areas or salmon species). At times several funding sources were needed to complete tasks (Figure 3).

Database Management System

A database management system (DBMS) is a collection of programs that enable one to store, modify, and extract information from a database (Webpeadia 2004). There are many different types of DBMSs, ranging from small systems that run on personal computers to huge systems that run on mainframes such as computerized library systems or flight reservation systems. From a technical standpoint, DBMSs differ in how they organize and display data. The terms relational, network, flat, and hierarchical all refer to the way a DBMS organizes information internally, and describe how quickly and flexibly one can extract information.

Components of a DBMS include the database, which is a collection of information organized in such a way that a computer program can quickly select desired pieces of data. Within the DBMS, requests for information from the database are made in the form of a query, which is a stylized question. The set of rules for constructing queries is known as a query language. Different DBMSs support different query languages, although a semi-standardized query has a language called SQL (structured query language). The information queried from a database can be presented in various formats. Most DBMSs include a report writer program to enable output of data (the result of a query) in the form of a report. Many DBMSs include programs to extract data for exportation as a file, often as a spreadsheet (Excel for example). DBMSs may also include a graphics component to enable output of information as graphs and charts.

The final DBMS for AYK salmon will be run on a personal computer sized server. Access to the DBMS will be through the Internet from a web site maintained by AYK Region staff. Its database structure will be relational and queries will be written in SQL. Queries will be written to generate reports and export data as Excel spreadsheets. Sections detailing the hardware and software requirements follow.

Goal, Objectives, and Development Steps for the AYK Salmon Database Management System

Goal: Provide managers, researchers, and public entities involved in salmon fisheries in AYK a system to submit and process new data as well as retrieve historic data for salmon ASL, escapement, and harvest.

Objectives:

1. Provide a system to store, modify, and extract location, agency contact, and general

metadata on salmon projects operated (past and present).
2. Provide a system to store, modify, and extract salmon ASL data, escapement count data, escapement survey data, test fishery data, and tagging data.
3. Provide a system to extract data for reporting salmon subsistence and commercial harvest data.
4. Provide a system to direct users to the appropriate web site or contact address to obtain AYK salmon data maintained outside ADF&G or outside the AYK Region of the Commercial Fisheries Division.

Steps defined for development of a database management system:

1. Create an inventory of available salmon data.
2. Conduct a preliminary needs assessment survey.
3. Transfer important data in imminent danger of being lost from degradation in media to a more permanent storage media.
4. Aggregate, standardize, and edit (missing identifier codes) data.
5. Create intermediate databases in Microsoft Access for reporting and editing historical data and entering new data.
6. Write a scope of work for the AYK salmon DBMS to include an integrated SQL Server (Microsoft 2000 version) database with web-access.
7. Develop prototype; show to users; get feedback.
8. Develop software according to the scope of work and user feedback; load data from Access databases (from step 5).
9. Continue to modify database with feedback from users.
10. Add additional datasets as indicated in the scope of work and/or as requested by users.

These database development steps have been and continue to be funded by several sources (Figure 3). Project FIS 00-016 addressed the first two steps in the database development process while project FIS 02-069 focused on steps 3, 4, and 5. NOAA and AYK SSI projects will fund completion of steps 4 and 5. Norton Sound Salmon Research and Restoration fund and project FIS 04-701 will fund completion of steps 6 through 10.

AYK SALMON DATA TYPES AND STATUS

An enormous quantity of historical salmon data exists for the AYK region. More than 150 projects to monitor salmon harvests, escapements, and measure stock abundance and biological attributes have been conducted in the region in the last 40 years (Hamner et al. 2002). Subsistence salmon harvest information has been collected throughout the AYK Region (Burkey et al. 2001, Brase and Hamner 2002, Banducci et al. 2003, Georgette et al. 2003). Data from all commercial landings made in the region's salmon fisheries since 1969, consisting of over nine million commercial sales receipts (fish tickets) are available in electronic format. Salmon observations have been made on more than 315 streams in the AYK region and include over 70,000 records of daily and annual estimates of abundance before 1999. Although a substantial

increase in the number of new projects has occurred since 1995, many, such as the Kogrukluk Weir with thirty-five years of fish passage data, are long standing projects. Biological information has been collected for over forty years from harvests and escapements to estimate age, sex and length composition of these salmon populations.

The disorganized state of the large volume of historical data pointed to the need for a region wide system of archiving electronic data. During the era of mainframe computers, data processing for most major data sets was centralized and controlled and standard codes and formats were enforced. More recently, personal computers have allowed biologists greater independence in controlling and analyzing project data. However, as a result of this independence, data coding, error-checking, and storage have diversified or become nonexistent and some data residing with project leaders have been lost during staff turnover. Currently, historical fisheries data are stored in hardcopy or various electronic formats such as text (ASCII), spreadsheet and word processing files. These data are stored in various locations by project leaders using diverse and often obsolete storage media (digital tapes or 5 ½" diskettes with various formatting). For a variety of reasons such as staff transitions, degradation in storage media, missing data identifiers and/or a disorganized system of file management and archiving, valuable historic data could be lost.

During the initial inventory (Hamner et al. 2002), four major categories of salmon data were identified: (1) biological (ASL) information, (2) escapement data, (3) subsistence harvest data from surveys and (4) commercial salmon catch and effort data from "fish tickets". Minor categories of data included tagging, stock enhancement, and stock identification data. ADF&G has also collected pathology data on AYK salmon. Metadata were also identified as a requirement of federally funded projects.

Age, Sex, and Length

Salmon age, sex, and length data are collected annually from sampled commercial and subsistence harvests and escapement, run timing and abundance monitoring projects in the AYK Region. Scales are collected primarily to determine the age of fish, but may also be examined for growth patterns. Since the distance between scale annuli represents the growth of a fish in one year, scales are a permanent record of annual growth over the lifetime of an individual salmon. Salmon length is generally represented by a measurement to the nearest five millimeters from mid-eye to fork of tail. Sex of the salmon is determined from either external characteristics or internal inspection of reproductive organs.

Age, sex, and length data have been collected in the Yukon Area since 1960, in the Kuskokwim Area since 1961 and in the Norton Sound-Kotzebue Area since 1962. All salmon species have been sampled but the emphasis has been on chum and chinook salmon. Scales collected from salmon are stored on gum cards along with an acetate impression used to determine age. Both are organized into files by year, species, and project. They are stored in cabinets located in the Anchorage and Nome ADF&G offices. Paper copies of ASL data are filed in the same locations. In most years, ASL data were converted to electronic data files located on either mainframe or

personal computers. However, no formal archiving system was established and much of these electronic data have been lost.

Intermediate Access databases were developed for AYK ASL data. All Norton Sound data through 2003 have been loaded into one of these databases and edited. Most other ASL data have also been loaded. A data entry form (electronic screen) was created so that technicians could enter data recorded on older handwritten forms into another Access intermediate database. Data were keyed and maintained in separate databases to allow for specialized error-checking procedures. A research analyst and an analyst programmer wrote database queries to detect and correct data entry-associated errors.

A query to generate an inventory of loaded data was also created. The query builds a table describing the number of individual salmon samples by species, year, district, and subdistrict. The database structure for ASL data was also revised to optimize data storage efficiency and compatibility with hypothetical future data structures.

Nearly all ASL data in electronic form have been merged and now reside in a Microsoft SQL central database. Only Yukon River chum and coho salmon ASL data remain to be hand entered and the forms reside in a single "bankers" box. Some electronic data needs to be loaded into the SQL database. Data editing is an ongoing process. Segments of the ASL database have had a thorough preliminary editing, such as Norton Sound. For the other areas, codes still need to be standardized. Biologists, project leaders, and users of the data need to be drawn into the editing process.

Escapement

Abundance of salmon returning to spawn in rivers throughout AYK is monitored using aerial, ground, and boat surveys, weirs, counting towers, fish wheels, sonar, and test fisheries. Raw counts of salmon "escaping harvest" (i.e. escapement data), such as hourly passage counts through weirs or past towers, or the number of salmon counted from aircraft or boats, are generally entered and stored in distinct spreadsheets for each project and year. These files are created and maintained by ADF&G biologists responsible for the monitoring project. The raw data for large sonar projects such as Pilot Station on the Yukon River are stored in database software Rbase or Access. Area managers may combine current and historical data from numerous escapement projects into integrated spreadsheets for inseason management use. The most complex of these integrated spreadsheets is the Yukon Area 'spread web' (Sollee 2003, Poetter 2004), which includes historical averages and daily counts for key Yukon Area escapement projects.

In 1996, NOAA Earth System Data and Information Management System Program (RFP 52ABNF600096) funded ADF&G to develop a database on the status of Alaska salmon populations (SASPOP). The goal was to develop a geo-referenced database, to include links to

the Anadromous Waters Catalog (AWC)[1], of salmon escapement data collected statewide between 1960 and 1998. The SASPOP database was initially developed for southeast Alaska and the fields and structure were most suited to the types of data collected in that region. Later, it was modified to incorporate escapement data for the entire state. Consequently, many of the fields are not applicable to the AYK region. Some portions of the project could not be completed because agreement was not reached on tasks such as creating a standard method of computing indices of escapement or a system of usage codes defining the appropriate use of these data. Lastly, this was a multiple year project and funding for it was not renewed after completion of the database for southeast Alaska. Work to extend SASPOP to a statewide application ended before completion in 1999. The Oracle software version of SASPOP is no longer maintained or updated by ADF&G.

Many spreadsheets of daily passage counts from AYK were standardized for inclusion in the SASPOP database before project termination. Other data were keyed from paper copies of project reports into a spreadsheet template created for the SASPOP project. These data were imported into database client-server software (Oracle) available in Access. The SASPOP project was terminated before all AYK data were edited, reformatted and incorporated into the database. An example of such uncorrected data is aerial, foot and boat survey data from Norton Sound, Kotzebue and Port Clarence area. These data are maintained in separate spreadsheets for each surveyed stream with a total of over one hundred separate spreadsheets. These data were not included because extensive reformatting was required to standardize them. Early aerial survey and other data retrieved from a now obsolete Honeywell mainframe computer were not incorporated into the database. An Access version of SASPOP with AYK-only data resides with AYK programming staff (hereafter referred to as the SASPOP escapement database). This database formed the model that the Access version of the intermediate AYK database for escapement data was built upon.

Currently the Access database of AYK escapement data includes (1) escapement count data (tower, weirs, and sonar) previously in the SASPOP database, (2) additional escapement count data from the Norton Sound area through 2003, and (3) aerial, ground, and boat survey data through 2003 for the Norton Sound area only. Norton Sound data are the most complete and well edited. Aerial, ground, and boat survey data for the 1980s through mid-1990s reside in an Rbase database for the Kuskokwim area and an Access database (of unknown similarity to SASPOP in structure) for the Yukon area. Data from these databases will be extracted and added to the AYK escapement database. More recent survey data will be added to the AYK database from paper survey forms stored in Anchorage, Fairbanks, and Bethel.

Subsistence Harvest

As of 2002, approximately 9,050 households annually harvest salmon for subsistence in AYK Region. In general households are surveyed post season to collect subsistence data. The first

[1] The AWC is a catalog of waters important for the spawning, rearing or migration of anadromous fishes of Alaska, maintained by ADF&G Division of Sport Fish and available on the web at, http://www.sf.adfg.state.ak.us/SARR/FishDistrib/anadcat.cfm

survey of subsistence harvests took place on the Yukon River in 1919; however, harvests were not reported by village until 1931. Systematic surveys have been conducted annually since 1960 in the Kuskokwim Area, 1961 in the Yukon Area, 1963 in the Norton Sound Area, and 1967 in the Kotzebue Area. Surveys during the early years only documented harvests of chinook and small salmon (all other salmon species combined). Most surveys included the number of fishing families, and type of gear and number of dogs per household. An overview and comparison of the subsistence methods used in each area and the history of data collection were reviewed and summarized by the statewide subsistence harvest assessment working group (Caylor 2000) funded by project FIS 00-017.

Detailed information on harvests by species, number of households, dogs in each household, and other information is collected and maintained by Subsistence Division (SD) of ADF&G for the Kuskokwim, Norton Sound, Kotzebue, and Port Clarence areas; by ADF&G Division of Commercial Fisheries for the Yukon area, and by Canada Department of Fisheries and Oceans for the Canadian portion of the Yukon drainage. Annual harvests by Alaskan community are included in a statewide database maintained by Subsistence Division. The results from subsistence harvest survey projects are reported in Division of Commercial Fisheries annual management reports (Ward et al. 2003, Banducci et al. 2003, and Vania et al. 2002) and in a separate Regional Informational Report (RIR) for the Yukon River (Brase and Hamner 2002). From 1988 through 2002, subsistence household survey and permit data for the Yukon River were stored in separate files for each year in what is now obsolete database software (Rbase). Yukon River subsistence salmon harvest data are collected by a single project and data format and coding standards have been enforced since 1988.

Though subsistence salmon harvest was identified as a data category, data for areas not surveyed by the Division of Commercial Fisheries will continue to reside in the centralized database maintained by Subsistence Division in Anchorage. As yet undecided is whether higher level harvest summaries will reside in the AYK salmon data management system or if a link between databases will be developed. A link between databases is the preferred method unless database architecture or accessibility dictates inclusion of higher-level summaries. This data category will be added or database links developed initially for the Norton Sound area as a deliverable for the NSSRR project. Yukon River subsistence harvest data will also reside in the AYK database management system until such time a link with the Subsistence Division is agreed upon and developed.

Yukon Area subsistence survey and permit database files for all years, 1988–2002, were successfully transferred to Access databases, with one database file for each year. All files are currently stored on the AYK Region server in Anchorage. In addition, these Access databases were provided to the Subsistence Division to be included in their Alaska Subsistence Fisheries Database (Caylor and Walker 2003).

Subsistence harvest data accessible via the Internet from Subsistence Division consist only of harvest data for years and communities studied in depth and do not include annual salmon harvest data as collected historically throughout AYK. This community profile database must be downloaded from the Subsistence Division web site and viewed in Microsoft Access which must be available to the user.

Commercial Harvest

Generally, a sales receipt ("fish ticket") is issued each time salmon are sold by fishers participating in Alaska's commercial fisheries. Electronic records of these fish tickets from 1969 to the present are archived by the Division of Commercial Fisheries, Computer Services Section, in the ADF&G office in Juneau. Fish ticket data have been entered inseason since 1981 in Emmonak and 1984 in Fairbanks, Nome, Bethel, and Kotzebue. Both hardcopy fish tickets and electronic data are archived post season in Juneau. Beginning in 2000, fish ticket information was entered and archived in a centralized Oracle database located on a server in the Computer Services Section office in Juneau. An ongoing project imports and corrects historical data for the years 1969 through 1999 into the new data system and data back to 1985 are currently converted. Commercial harvest data are not currently accessible to the general public through the Internet, and data back to 1985 are available through the State's wide area network (WAN) only to ADF&G staff with fish ticket application software loaded onto their personal computer. All other data requests must be directed to the Computer Services Section in writing.

Though commercial harvest was identified as a data category during the initial inventory (Hamner et al. 2002), fish ticket data will continue to reside in the centralized database maintained by Computer Services Section in Juneau. Data back to 1985 will be extracted from that database by the AYK salmon DBMS for reporting. Architectural and consistency problems may necessitate that higher level catch summaries for years before 1985 reside in the AYK salmon DBMS. This data category will be one of the last to be added and will initially be added only for the Norton Sound area as a deliverable for the NSSRR project. Commercial harvest data are currently collected, entered, stored, and reported in a standardized manner following policy developed by the Computer Services Section in consultation with fisheries managers throughout the division.

Test Fisheries

Fishery managers collect salmon abundance, distribution and run timing information from test fisheries. Standardized gear and fishing procedures are used by ADF&G employees or other cooperating groups. Explicit location, time of day (if less than continuous) and gear dimensions are used to capture salmon information. Data are expressed as catch per unit effort (CPUE). Test fisheries can monitor salmon migrations 24 hours per day, seven days per week. Fish wheels, set gillnets and drift gillnets have been used in AYK. CPUE has been expressed for gillnets as number of salmon per 100 fathom hours fished. Test fisheries data currently reside in individual spreadsheets under the control of the project leader located in AYK area offices.

Norton Sound test fishery data will be added to the AYK salmon DBMS during this scope of work as a deliverable of the NSSRR project (before June 30, 2007). Data from other AYK test fisheries will be included, as time allows, though a higher priority will be placed on including these data after June 30, 2007.

Tagging Data

Projects have been operated in AYK in which tags are placed on or in salmon to monitor migration pathways, spawning destinations, travel time, or are used in mark-recapture experiments to estimate abundance (Hamner et al. 2002). These data either reside in spreadsheets or published reports only. Data from a radio telemetry project for chinook salmon in the Yukon River and a spaghetti tagging project for chum, sockeye, and coho salmon in the Kuskokwim River reside in project specific Access databases and Excel spreadsheets and could be added to the AYK salmon DBMS. A number of tagging projects (spaghetti or radio telemetry) conducted by Federal agencies will be referenced in the project-listing database and the AYK salmon DBMS user will be provided with contact information.

The Mark, Tag, and Age Laboratory of the Division of Commercial Fisheries provides detailed information about thermal marks induced in fish otoliths and maintains a centralized state DBMS for tracking salmon using microscopic tags (coded wire tags among others). Coded wire tags have been placed in chum salmon and chinook salmon released into the Yukon River. A web site provides access to the fisheries data in these databases through online reports. The AYK salmon DBMS will direct users interested in these data to this web site.

Enhancement Data

ADF&G oversees and regulates all salmon rehabilitation and enhancement projects conducted by the department or others. The permitting process for such projects requires the collection of data and approval by geneticists, pathologists, and biologists. Permit and production data are maintained by staff in the Division of Commercial Fisheries located at the headquarters office in Juneau. Few enhancement projects have occurred in AYK. Fertilizer was added to Salmon Lake (which drains through Pilgrim River into Norton Sound), incubation boxes for chum salmon were placed in several rivers in the Norton Sound area (Hamner et al. 2003b), and chum salmon were raised at the Clear Creek Hatchery for release into the Yukon River drainage (Hamner et al. 2002). Data from these projects will not be stored in the AYK DBMS. Project name, location, and other pertinent data will reside in the project-listing database. Users of the AYK salmon DBMS interested in these data will be directed to the appropriate web site or contact address.

Stock Identification Data

Projects to identify and delineate stock structure have been conducted on salmon of the AYK Region (Hamner et al. 2002). Various techniques used to differentiate stocks include scale pattern analysis and genetic techniques. An ongoing scale pattern analysis project for Yukon River chinook salmon archive data in individual files. These data will not be included in the AYK DBMS. Project details will be in the project listing database and interested users will be provided contact and address information.

Gene Conservation Laboratory of the Division of Commercial fisheries has conducted studies on salmon in the AYK region, using molecular techniques to detect genetic variants. These markers describe genetic relationships among populations and species and have been used to identify population units (discrete stocks) and individuals of particular stocks in mixed-stock samples. The Gene Conservation Laboratory maintains a web site describing ongoing projects, publications, and staffing. AYK salmon DBMS will direct users interested in genetic data to this web site.

Pathology Data

Fish Pathology Section of the Division of Commercial Fisheries monitors and controls finfish and shellfish diseases statewide (according to Title 16 of the Alaska Statutes) by conducting diagnostic surveys, developing finfish and shellfish disease policies, and advising the Commissioner of the ADF&G and other state and federal authorities on fish disease issues. Disease data have been gathered on chinook salmon throughout AYK (Ithyophonus) and in all salmon associated with enhancement activities. Data from these projects will not be stored in the AYK DBMS. Project name, location, and other pertinent data will reside in the project database. Users of the AYK salmon DBMS interested in these data will be directed to the appropriate web site or contact email address.

Metadata

Metadata are a description of a dataset's content, quality, lineage, contact, condition, and other characteristics. The description of the data is organized in a standardized format using a common set of terms. Metadata is literally "data about data". The National Biological Information Infrastructure (NBII) division of the U.S. Geological Survey provides a clearinghouse of metadata.

Metadata will be created for inventoried data in AYK according to standards for biological datasets by the NBII (USGS 2004). AYK staff have attended a workshop conducted by NBII and purchased their recommended software. Interim grouping levels for metadata have been developed. Metadata for ASL data will be developed for each grouping by area (Kuskokwim, Yukon, Norton Sound/Port Clarence, or Kotzebue), species, and project type (e.g. Norton Sound, chum salmon, test fishing). A Metadata record will be developed at the level of area, species, and project for escapement count data (e.g. Norton Sound, chum salmon, Nome River weir) and by area and species for escapement survey data. Metadata will be updated annually. Grouping levels may change and more detailed information may be included each year until Metadata are finalized in June 2007.

AYK SALMON DATABASE MANAGEMENT SYSTEM

Overview

The AYK DBMS will offer users three levels of access through the Internet to AYK salmon data (Figure 4). Priority data sets collected or maintained by AYK region CF staff will reside in a database in which users can store new data, modify existing data, and extract data for reporting and further analysis. Other priority datasets maintained in client-server SQL compatible databases by ADF&G staff will be accessible to extract data for reporting and analysis only. Users interested in other datasets not readily accessible by the AYK DBMS but maintained by ADF&G and or listed as an AYK project in the AYK DBMS will receive either a contact email address or web site link.

Six datasets maintained by AYK region CF staff are of high enough priority to be included in the AYK DBMS during the first phase of the project (through June 30, 2007). The datasets include (1) AYK project listing, (2) ASL data, (3) escapement count data from towers, weirs, and sonar, (4) escapement data from aerial, ground, and boat surveys, (5) Yukon River subsistence harvest data, and (6) test fish data for the Norton Sound area. Users will be able to store current year data, modify historic data, and extract data for analysis and reporting. Not all users will have permission to store and modify data though all users will be able to extract and report data. Additional datasets scheduled to be included as time allows before June 30, 2007 or during the second phase ending June 30, 2009 include the remaining test fish data for AYK and tagging data from projects conducted by AYK Region CF.

Two datasets maintained by ADF&G staff outside the AYK Region are of priority interest (Hamner et al. 2002) to potential AYK DBMS users and are not currently web accessible. Both commercial and subsistence harvest data reside in client-server SQL compatible DBMS accessible by the AYK DBMS. Users of the AYK DBMS will be able to extract non-confidential data and run summary reports (for example commercial catch by day, area, and year). Initially, applications will be developed to extract data from these databases for the Norton Sound area as a deliverable for the NSSRR project (by June 30, 2007). Extending the capability to the rest of AYK data will occur as time allows with a higher priority placed during the second phase of the project (July 1, 2007-June 30, 2009).

The AYK DBMS will provide users interested in all other data collected by ADF&G or referenced in the AYK project-listing database with a link to the appropriate web site or a contact email name and or address. Examples of ADF&G laboratories, which maintain their own data, are the Gene Conservation Laboratory, Pathology Laboratory, and the Mark, Tag, and Age Laboratory, each with web site and contact information. Other projects accessible in the AYK project-listing database will provide agency contact, address, and or email address.

Relationship of Intermediate Databases to the Final Central Database

AYK DBMS is being built in two steps; 1) data initially stored and maintained in intermediate databases created in Microsoft Access and 2) data moved to their final destination in a Microsoft SQL central database (Figure 5). Rudimentary data entry screens, editing and reporting applications are also being developed in Access. This intermediate step was necessary because staff who started this project was most knowledgeable in Access and it possessed features most useful to the intermediate process of data aggregation and standardization. Each data set resided in its own Access database and can be run from personal computers not necessarily connected by the Internet. All data placed in Access intermediate databases have been or will be moved to a Microsoft SQL 2000 central database (Figure 5).

The intermediate Access databases will be recycled primarily in the role of standalone (in-season) data collection. Most inseason data collection is done without Internet or networking capabilities and most of the functionality already implemented in these databases fills this niche.

Access databases will also undergo another metamorphosis into what are known as Access Data Projects (ADPs). ADPs are essentially Access databases with all the user interface functionality of an Access database (forms, reports, queries) but with the actual data residing in one centralized SQL Server database. ADPs will be another “intermediate” interface to serve as bridge between some short-term requirements for accessibility and the ideal and final implementation of those requirements within a web interface. For example, one highly desired output of any database management system is reports. Microsoft SQL Server has not, until very recently, had its own inherent reporting system. The ADP fills this void in a very attractive way. Many ADF&G staff have a familiarity with Access, which can allow them in this scenario to build their own reports without any risk of compromising the integrity of the data.

Computer Hardware Requirements

In 2003 a server (Table 1) was purchased with funding from the NSSRR project and is currently acting as the AYK salmon database and Intranet server. Two additional servers (see Table 1 for exact specifications) will be purchased with funds from project FIS 04-704, one database server and one web server. The database server will reside behind the state's firewall and house all of AYK's data within a Microsoft SQL Server 2000 database. The web server will be accessible from the Internet and provide public or agency access to AYK data, and to serve as a secured portal for AYK staff to access their data. The server purchased under NSSRR will then be freed to serve three ways: as purely an Intranet server, as a replicated database server, and as a testing server. All servers will be backed up nightly using existing equipment on the Commercial Fisheries Division local area network in Anchorage.

Computer Software Requirements

Under NSSRR, much of the core software has been purchased for the development of the AYK DBMS (Table 1). Microsoft Visual Studio .NET Professional 2002 is an Integrated Development Environment (IDE) that allows programmers to develop native Windows and web applications that run on the .NET framework. Most future interface development (barring Access work) will be done in Visual Studio .NET, and some development has already begun with Yukon River subsistence survey data. Microsoft Visual Studio .NET Professional 2003 will be purchased to (1) provide adequate license coverage and (2) take advantage of its many enhancements for the 2003 version, such as enhanced reporting capabilities. Microsoft SQL Server 2000 with 5 CAL (Client Access Licenses) was purchased and serves as the database software used to house the central repository of data. In the future more licenses for SQL will need to be purchased if the volume of use increases greatly, but the current purchase should reasonably serve AYK needs in the near future. AYK Region's Microsoft Access will be upgraded to the 2003 version for work with ADPs. CA Brightstor ArcServe 2000 Backup Agent was purchased at the request of the CF network administrator to integrate database backup with the existing network backup infrastructure. SMMS Version 5.1was also purchased to develop AYK metadata.

Internet Accessibility

The AYK DBMS will be accessed through an ADF&G Internet site maintained by AYK Region staff. Though Internet accessibility of the AYK salmon DBMS is deliverable for 2007, it is a capability currently being developed. The Internet offers some resolution to AYK Region network connectivity issues. While any sort of connectivity is scarce at field locations, even AYK area offices have many problems with the State's wide area network (WAN). Response times over the WAN from Bethel to Anchorage and even Fairbanks to Anchorage are so prohibitively slow staff in those offices either avoid using remote network drives or simply copy files down to local drives to complete their work. In contrast, Internet access in these offices, compared to WAN access, is fast and reliable. The Emmonak office uses a high-speed satellite Internet connection in preference to connection to the state's WAN. This means all state network resources are unavailable to them unless they dial Anchorage at a much slower connection speed and higher cost.

Some key characteristics of web development make it a preferred method of development over the traditional client-server application:

1. Rapid, centralized deployment – when developers need to make programmatic changes within a system (which is chronic), the developer typically needs only to change the program in one place, at the web server. In client-server development (i.e. ADP) there is a chance that you need to make the changes at the client's computer as well. This change is often complex and depends on the individual user's machine and software.

2. Quick response times – in web development, when a query of the data is made by the user, the actual query and the result set are passed for the most part between the web server and the database server (which typically are networked together at high-bandwidth). In a client-server paradigm, when a user makes a query, the query and result set are passed between wherever the user might be and the database server. In rural Alaska, this transaction could be over a dial-in connection from Kalskag.

The process of development towards Internet accessibility in this project can be described in terms of three major components; Standalone Access databases, ADPs, and Web access. The Standalone Access component, at this point the most developed, is essentially an intermediate database cleared of all data and used for inseason data collection, editing and reporting. They will reside on individual staff's computers and not depend on Internet or WAN access. The ADP component, which will be developed from the intermediate databases, will be used as a central collection point for data collected during (with Standalone databases) or at the end of the particular field season (loaded from Standalone databases). The ADP component will have core functionality like data entry, editing, importing and reporting already carried over from existing development, and will serve (at least initially) as a primary tool for regional offices to collect and correct new data before finalizing it and merging it into the central repository. The central database structure in Microsoft SQL Server 2000 will consist of two sets of tables. The first set is the "staging" area whose tables will follow closely the structure of the Standalone Access databases (this is the set that the ADPs will serve primarily as a front end to). The second set is the main central structure housing only verified and finalized data. The Web component will be a web application written in ASP.NET using Visual Studio .NET and serve as an interface to the central data repository, with some core functionality such as raw data display and export, and some reporting. This component will have a login system that will determine the level of access to the data (public, agency, project staff, etc).

During development and testing the web component will be accessible only within the state's network, and serve as a sort of "intranet" website, likely to be hosted on our existing intranet server purchased under NSSRR. ADP and standalone components will be presented as part of the system at each scheduled presentation. The Standalone component will be used for data collection by Norton Sound staff beginning June 2005. Final testing of the web component by AYK staff will begin March 2007. The web component in this phase will still be accessible only within the state's WAN. Only when all staff are satisfied with all group and individual's level of access and functionality will the site be made public which will need to occur by June 30, 2007.

Project Personnel, Deliverables, and Timeline

Personnel in AYK's Information Technology (IT) unit have been assigned to develop the AYK DBMS in coordination with their Regional Research Supervisor. Seasonal technicians will also be hired as needed for data entry and editing tasks. IT staff funded by a variety of projects will work on other assignments in addition to the DBMS.

Seth Darr is an Analyst Programmer (AP) IV and the supervisor of AYK's IT unit. Seth began

work for AYK Region October 2002 transferring from the Alaska Court System. Previously, Seth taught programming and worked as a software engineer in Pittsburgh. Seth has a degree in Computer Science from the University of Pittsburgh at Johnstown and brings expertise in Microsoft SQL Server, Access databases and web applications. Seth's salary is paid with State of Alaska (SOA) general funds and a grant from NOAA for Yukon River US/Canada salmon treaty support.

Holly Moore began work as an AP III with AYK Region in January 2003. Previously, she was the database manager for ADF&G's shellfish observer program in Dutch Harbor, and brings to the IT unit 10 years of experience as a fisheries biologist/technician on the Yukon River dealing with test fisheries, fish tickets, subsistence surveys, ASL sampling, and stock identification projects. Holly is currently working towards her degree in Computer Science from UAA and is funded entirely by SOA general funds.

Shane StClair is a Research Analyst I and began work with AYK Region in July of 2002 shortly after graduating from UAA with a BS in biology. Initially responsible for posting fishery announcements and aggregating ASL data, Shane has expanded upon his duties to become the region's webmaster, and recently began preparing the AYK herring forecast. Shane is funded by SOA general funds for web duties and herring and NSSRR and FIS 04-701 for AYK salmon DBMS duties.

A permanent AP III position has been created to complete work on the AYK salmon database management system as funded by NSSRR and project FIS 04-701. Interviews for this position have been completed and an appointment is pending. The successful applicant should begin work October 15, 2004.

Linda Brannian is a Regional Research Supervisor, Fishery Biologist IV. Linda will be responsible for preparing progress reports, annual reports, and final reports for the NSSRR project and project FIS 04-701. She will also obtain the necessary commitment from biologist staff for data editing and ensure compliance with data collection standards.

Development of the AYK salmon DBMS has been made possible through funding from the NSSRR project and project FIS 04-701. These two projects in addition to SOA general funds support development of most system components (Figure 6). Funding agreements outline deliverables to support project objectives (Table 2) forming a system timeline. Currently the timeline and deliverables differ between the NSSRR and OSM project. AYK Region will request NSSRR project deliverables be modified to more closely align with project FIS 04-701, especially the date of full web accessibility. Funds have not been identified to add tagging data from projects conducted by AYK CF (Figure 6) and for the development of web links or contact information for projects other than escapement count and survey projects operated by non-governmental organizations, Federal agencies, and universities.

Tasks necessary to accomplish objectives and prepare deliverables have been defined and assigned to IT personnel. Seth Darr, with support from the vacant AP III, will develop and maintain the SQL central database and web accessibility (data entry, data editing, importing, and exporting) and be responsible for the Yukon subsistence harvest data component. Holly Moore

will be responsible for the ASL Access intermediate database, the "Standalone" for inseason data collection, and the ADP, with data loading and editing support from Shane StClair. Holly will also be responsible for the Metadata component. Shane StClair will be responsible, with programming support from Seth, for the project-listing database. ADPs and Intermediate Access databases for escapement data (count and survey data) will be the responsibility of Seth and Holly with loading and editing assistance from Shane. Technician staff will be hired to enter data from paper forms and edit data. A detailed timeline has been developed through the end of 2005 and will be updated annually for the duration of the project. The software used to maintain this timeline does not allow for a presentation easily imported into manuscripts. Thus, inclusion here is for illustrative purposes only and is not meant to be read in detail (Figure 7).

Data Collection Standards

Efforts to standardize existing data collection and storage are a critical foundation for building a database management system. Authority to require standardization is the first step. Development of standard codes and standard data collection and storage formats is the second step. The third step is compliance with and enforcement of those standards. The first step was accomplished when AYK database projects were approved by the AYK Regional Supervisor for the Division of Commercial Fisheries (ADF&G) before submission for funding. When funded, these projects represented the region's commitment to the necessary steps in database development and provided authority for project investigators to begin standardizing data collection. AYK staff needed to develop policy for standard data collection and storage as required by project objectives. Presentations were made to ADF&G staff at their annual staff meetings about ongoing projects and the need to standardize data collection and storage for ASL and escapement data. These two data sets that had been centralized during the era of mainframe computer data processing and had standard codes and formats enforced until the early 1990s. Following these presentations the Regional Supervisor empowered the region's programmers to develop and enforce standards after working with affected staff to develop data entry screens, computer editing routines, and reporting that will create standard data collection and storage procedures. As development of the AYK database management system continues, annual updates and meetings with affected staff will occur. When current year data are entered into the AYK salmon DBMS the need for individual files as cause of dissimilar formats will be gone.

The second step represents the development of standards for data collection, codes, and storage formats. Through work with Nome area office biologists, data collection for Norton Sound, Kotzebue, and Port Clarence is standardized for 2004. With the development of intermediate Access databases for Norton Sound ASL and escapement data, a standard code table and data storage format has been developed. Norton Sound data through 2003 reside in these databases and represent a standard for data collection, storage, and use of codes. These prototypes were extended to the rest of the region; similar databases have been populated with non-Norton Sound data. These databases will be presented at each 2004 postseason area staff meeting (Norton Sound/Kotzebue, Yukon, and Kuskokwim). The objectives of these presentations will be to (1) reinforce the commitment to a central database with standard data collection and storage, (2) identify biologists in each area responsible for compliance with these standards, and (3) plan

future meetings in 2004 and early 2005 with biologists responsible for ASL, escapement count, or escapement survey data for more detailed discussions of these standards.

The last step in standardization is compliance and enforcement. Compliance with code usage will occur as historic data are edited, reformatted, and loaded into intermediate databases (see Figure 5 for timeline). Data storage formats will be enforced as 2004 data are loaded, and compliance with data collection standards will begin in 2005 for ASL and escapement data.

The first step in standardizing data collection and storage is complete for all data components for the AYK DBMS maintained by AYK Region (Figure 5). The second and third step will only occur as work begins on data sets scheduled to be added later such as test fish data and tagging data. Because of the limited nature of the Yukon subsistence harvest data set, standardization and compliance issues remained within the control of a small group of project participants (biologists and IT staff) and the dataset required little additional effort to ensure uniformity.

Editing and Verifying Data

Editing and verifying data in the AYK salmon DBMS will occur in two steps. IT staff will undertake the first step while biologists or technicians under biologist direction will complete the second step. Data will not be available to the public before completion of these two steps.

During the first step IT staff will first edit data being loaded into intermediate databases. Data will be reviewed for record and field completeness, duplication of header information, key uniqueness, etc. Once data are loaded, duplicate datasets will be sought and deleted. Computer editing routines have been and are being built to detect out of range data, incorrect codes, etc., which will be researched and corrected.

In the second editing step, IT staff will work with project biologists or users of the data. Reports will be built to display data in previously published formats so biologists or technicians can compare results. Reasons for differences will be researched and corrections to the database will be made, or the reason for the differences will be noted. This second step is scheduled to be completed before web accessibility of the data.

FUTURE SYSTEM COMPONENTS AND PROJECTS

Although desired components of the AYK salmon DBMS have been identified for this scope of work, funding has not necessarily been secured to fully implement addition of all components by June 30, 2009. All components scheduled for completion by June 20, 2007 have adequate funding. The subsistence and commercial harvest components would benefit from funding in 2008 and 2009 to extend data extraction capabilities beyond the Norton Sound area. In addition, relying solely on State of Alaska (SOA) general funds to add test fishery data from the

Kuskokwim and Yukon areas is problematic. Additional funding is needed to add AYK Region CF tagging data.

One important project in particular warrants consideration for funding outside ADF&G. Currently, Yukon state and federal fisheries management staff rely on paper displays in notebooks for reference to historic Yukon River summer season chinook and chum salmon data (Sollee 2003) and a separate notebook for fall season chum and coho salmon data (Poetter 2004). These notebooks are labor intensive to produce. Data supporting these notebooks reside in Excel spreadsheets and have been colloquially referred to as Yukon "spread webs". The amount of data now included and the complexity of the macros and updating routines have taxed the capabilities of Microsoft Excel software resulting in occasional file contamination or run-time errors, which speak to having exceeded the resources of the software. These data storage and display (averages, ranges, statistics) capabilities could be moved out of a stand alone Excel spreadsheet and be integrated into the AYK salmon DBMS. Additional funding will be necessary and staff would be available in late 2006 or July 1, 2007 to begin such a project.

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Table 1. Computer hardware and software to be used for the AYK salmon database management system.

Equipment purchased under the NSSRR project[2]:

Web/database server

- Dell PowerEdge 2600 w/2GHz processor, 1G RAM, two 73GB hard drives in a RAID 1 configuration, running Windows 2000 Server

Software

- Microsoft Visual Studio .NET Professional 2002
- Microsoft SQL Server 2000 w/5 CAL's
- Computer Associates Brightstor ArcServe 2000 Backup Agent
- SMMS 5.1 (Spatial Metadata Management System)

Equipment to purchase under project FIS 04-701 and SOA[3] funds:

Web server

- Dell PowerEdge 2850 w/2.8GHz processor, 512MB RAM, 36G hard drive, running Windows 2003 Server

Database server

- Dell PowerEdge 2850 w/3.4GHz processor, 4GB RAM, two 73GB hard drives in a RAID 1 configuration, running Windows 2000 Advanced Server

Software

- Microsoft Visual Studio .NET Professional 2003
- Microsoft Access 2003 (as part of Office 2003)

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[2] NSSRR project is funded by the Norton Sound Salmon Research and Restoration fund.
[3] SOA is state of Alaska and includes general funds and other monies available to the AYK Region

Table 2. Annual objectives and deliverables for projects funded by the Norton Sound Salmon Research and Restoration Fund (left) and the USFWS Office of Subsistence Management (right).

Norton Sound Salmon Research and Restoration Project:	**USFWS Office of Subsistence Management Project**
Norton Sound Salmon Information Database	FIS 04-701 Develop Shared Fishery Database
July 1, 2002-June 30, 2003: 1. Create an inventory of existing data sources, (see: *Norton Sound Salmon Information Database, File Inventory and Problem Review, RIR 3A03-01)* 2. Create an Access database of detailed age data in a standard format 3. Create an Access database of aerial survey data in a standard format through 1998. 4. Create an Access database of daily escapement data in a standard format through 1998.	
July 1, 2003-June 30, 2004: 1. Create metadata for inventoried data according to standards set by the National Biological Information Infrastructure. 2. Escapement and ASL data updated to current year. 3. Intermediate data entry, editing and reporting systems developed so that data can continue to be added, edited and reported. 4. Escapement data will be rechecked for errors. 5. A georeferenced Access database of projects and project descriptions and history along with associated electronic data files and reports will be developed. 6. The location, text and photo description of projects that can be queried through a map-interface on our web site will be created. 7. A plan of software development and scope of work for the entire project, including an Internet accessible database, will be completed and documented in a report. 8. Access databases will be loaded into SQL	***August 1 – December 31 2004:*** 1. Complete a scope of work for the AYK salmon database management project. 2. Load daily escapement counts (from weirs, towers, sonar, etc) for salmon in the AYK Region, to include years through 2003, into intermediate databases. 3. Load aerial survey estimates for salmon in the AYK Region, for years in which data are currently available in electronic form, into intermediate databases. 4. Load ASL data for salmon in the AYK Region, to include years through 2003, into intermediate databases. 5. Develop data entry, querying, editing and reporting systems for the escapement count, aerial survey, and ASL intermediate databases so that all data can be edited and reported and future data can be added. 6. Develop an intermediate database of projects, project descriptions, lead agencies, years of operation, data collected, and electronic data

Server on new server purchased in FY2003. 9. The Access databases and reporting capabilities will be demonstrated to users; user comments and requested data sets not yet included considered for inclusion in 2004-2005. 10. Distribute CDs with Access databases to researchers	descriptions. 7. Create preliminary metadata for inventoried data according to standards set by the National Biological Information Infrastructure.
July 1, 2004-June 30, 2005: 1. Develop integrated SQL Server database with Internet data entry, editing, querying, reporting and downloading capabilities. 2. Populate server database. 3. A usage code indicating the appropriate use of escapement data will be added to the database, i.e. index, estimate, presence/ absence. Indicators of presence or absence of each species of salmon for each waterway will be added if needed. 4. Integrate the State of Alaska Watershed and Stream Hydrography Enhanced Dataset (AWSHED) Project developed by BLM and USGS. This watershed-based map system includes watershed definitions, water flow and standard water body identifiers. 5. Develop GIS component with map-based queries and reporting capabilities 6. Demonstrate system to users. 7. Begin incorporated additional datasets.	***January 1 – December 31 2005:*** 1. Present intermediate database systems (reports, editing, and data entry capabilities), preliminary metadata structure, and project database to users and collect comments. 2. Enter aerial survey data for the years that were not available in electronic form through 2004, into intermediate databases created in 2004 (Objective 3). 3. Standardize and error check escapement count data residing in intermediate databases created in 2004 (Objective 2); enter 2004 escapement count data. 4. Standardize and error check aerial survey data residing in intermediate databases created in 2004. 5. Standardize and error check ASL data residing in intermediate databases created in 2004; enter 2004 ASL data. 6. Develop integrated central database with preliminary data entry, editing, querying, reporting and downloading capabilities for escapement count, aerial survey, and ASL data incorporating comments. 7. Populate central database with data from intermediate escapement count, aerial, survey, and ASL databases. 8. Update metadata to account for additions to the database management system in 2005 and user comments. 9. Update intermediate project database.

July 1, 2005-June 30, 2006: 1. Continue incorporating datasets requested by technical/steering committees and users. 2. Deploy web-based GIS database 3. Meet with users to demonstrate and critique system 4. Continue to aggregate, standardized and incorporate other data sets requested by users. 5. Continued maintenance and improvement of user interface, reports, etc.	***January 1 – December 31 2006:*** 1. Present central database system (preliminary queries, reports, editing, and data entry capabilities), updated metadata, and updated intermediate project database to users and collect comments. 2. Enter escapement count, aerial survey, and ASL data from 2005 into the central database. 3. Enhance data entry, editing, querying, and reporting components of the central database of the AYK salmon database management system and respond to comments collected through Objective 1 in 2006. 4. Transfer data from the intermediate project database (2005 Objective 9) to the central AYK salmon database. 5. Develop web access to central database for AYK salmon. 6. Provide web accessibility to the central database system (data entry, queries, reports, and down loads through the web) to users and collect comments.
July 1, 2006-June 30, 2007: 1. Aggregate, standardized and incorporate other data sets as requested by users. 2. Continued maintenance and improvement of user interface, reports, etc 3. Modify and/or add data entry, editing, queries and reports based on users' evaluation.	***January 1 – June 30, 2007:*** 1. Enhance web accessibility to the central database system (i.e., queries, reports, editing, and data entry capabilities) in response to user comments from 2006. 2. Enter escapement count, aerial survey, and ASL data from 2006 into the central database through the web. 3. Provide access to the AYK database management system web site to ADF&G users for testing. 4. Finalize metadata. 5. Provide public access to the web site for the AYK database management system, June 30, 2007.

Figure 1. AYK Region management areas.

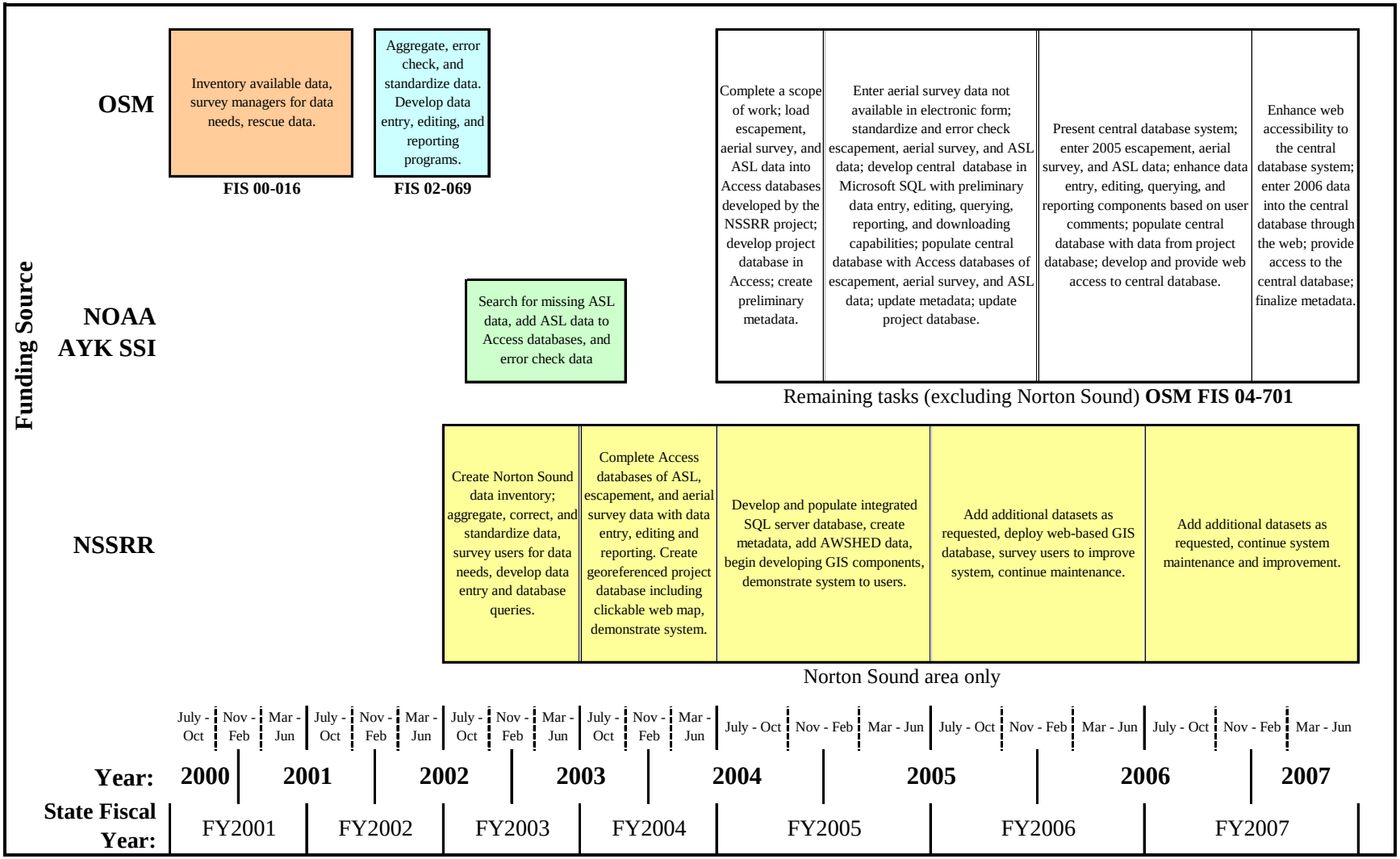
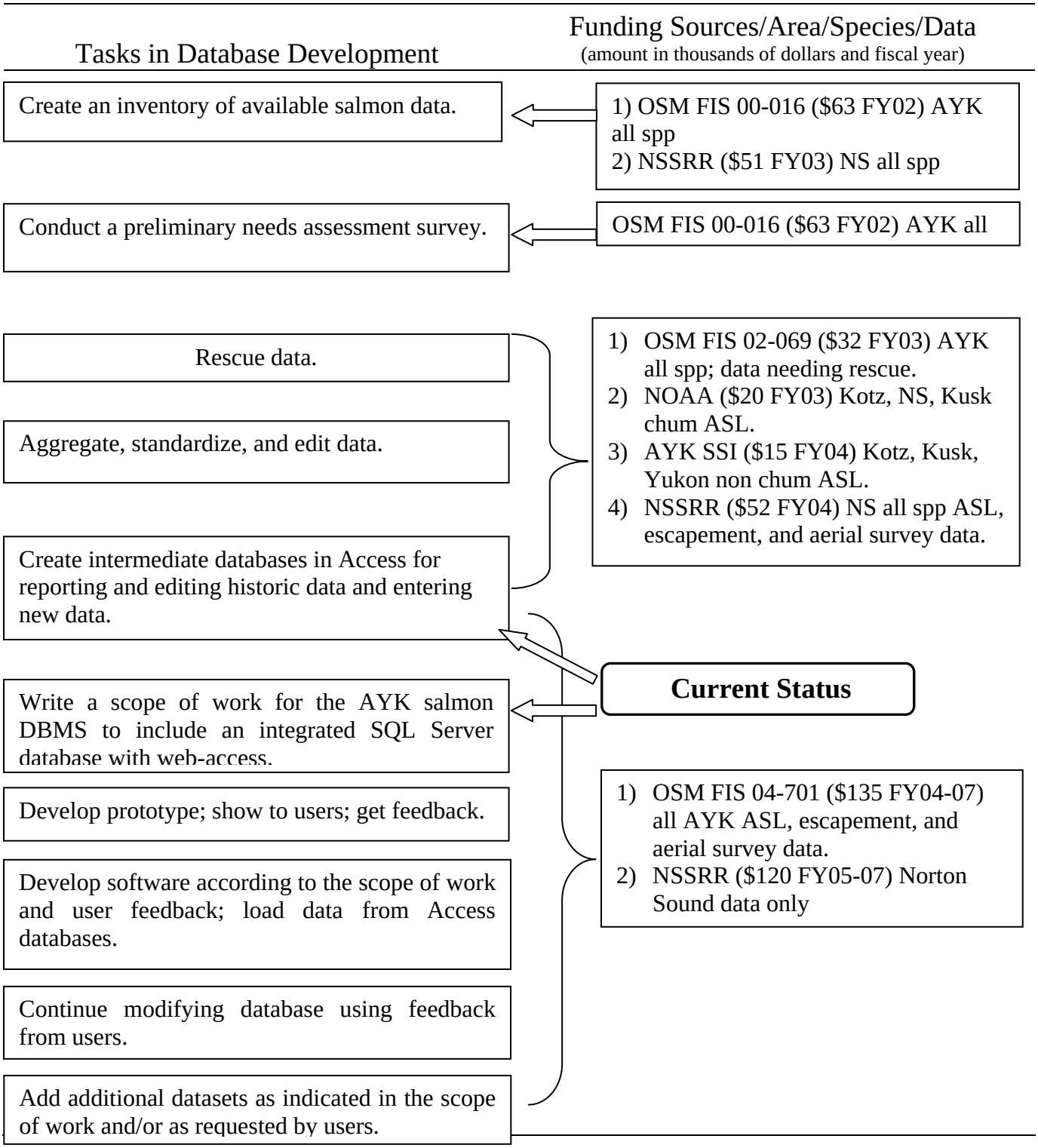


Figure 2. Project timeline for development of the AYK salmon database management system. (OSM= USFWS Office of Subsistence Management; AYK SSI= AYK Sustainable Salmon Initiative, NOAA=National Oceanic and Atmospheric Administration, NSSRR= Norton Sound Salmon Research and Restoration, FY is state fiscal year).



OSM= USFWS Office of Subsistence Management; NSSRR= Norton Sound Salmon Research and Restoration; AYK SSI= AYK Sustainable Salmon Initiative; NS=Norton Sound; Kotz=Kotzebue; Kusk= Kuskokwim; ASL= Age, sex, and length data; FY is state fiscal year.

Figure 3. Tasks for development of the AYK salmon database management system (DBMS) including funding sources, amounts by fiscal year, and area. Not included is state general fund support of an Analyst/programmer IV, Analyst/programmer III, and a Research Analyst I ($150,000 annually).

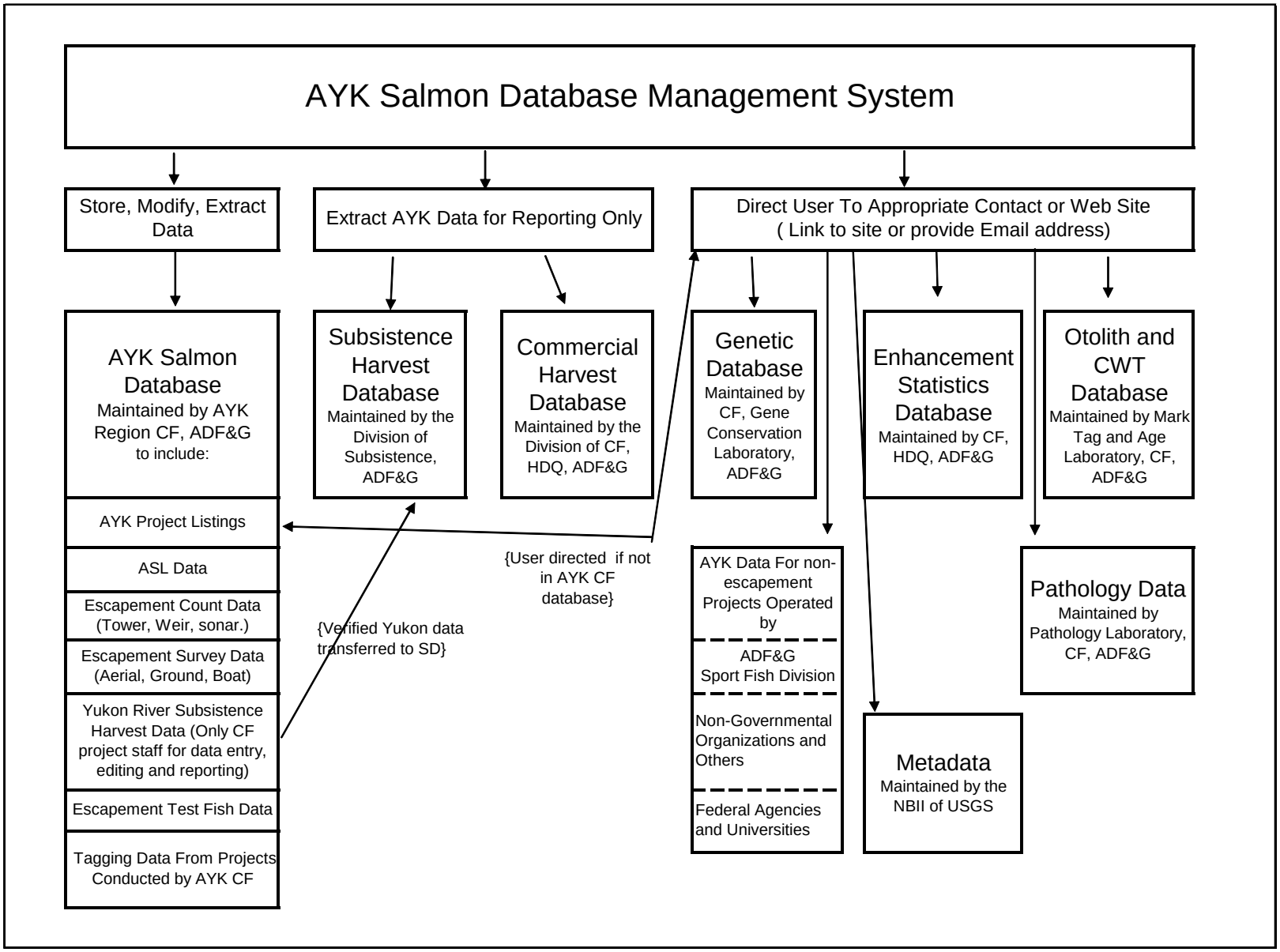


Figure 4. Components of the AYK salmon database management system.

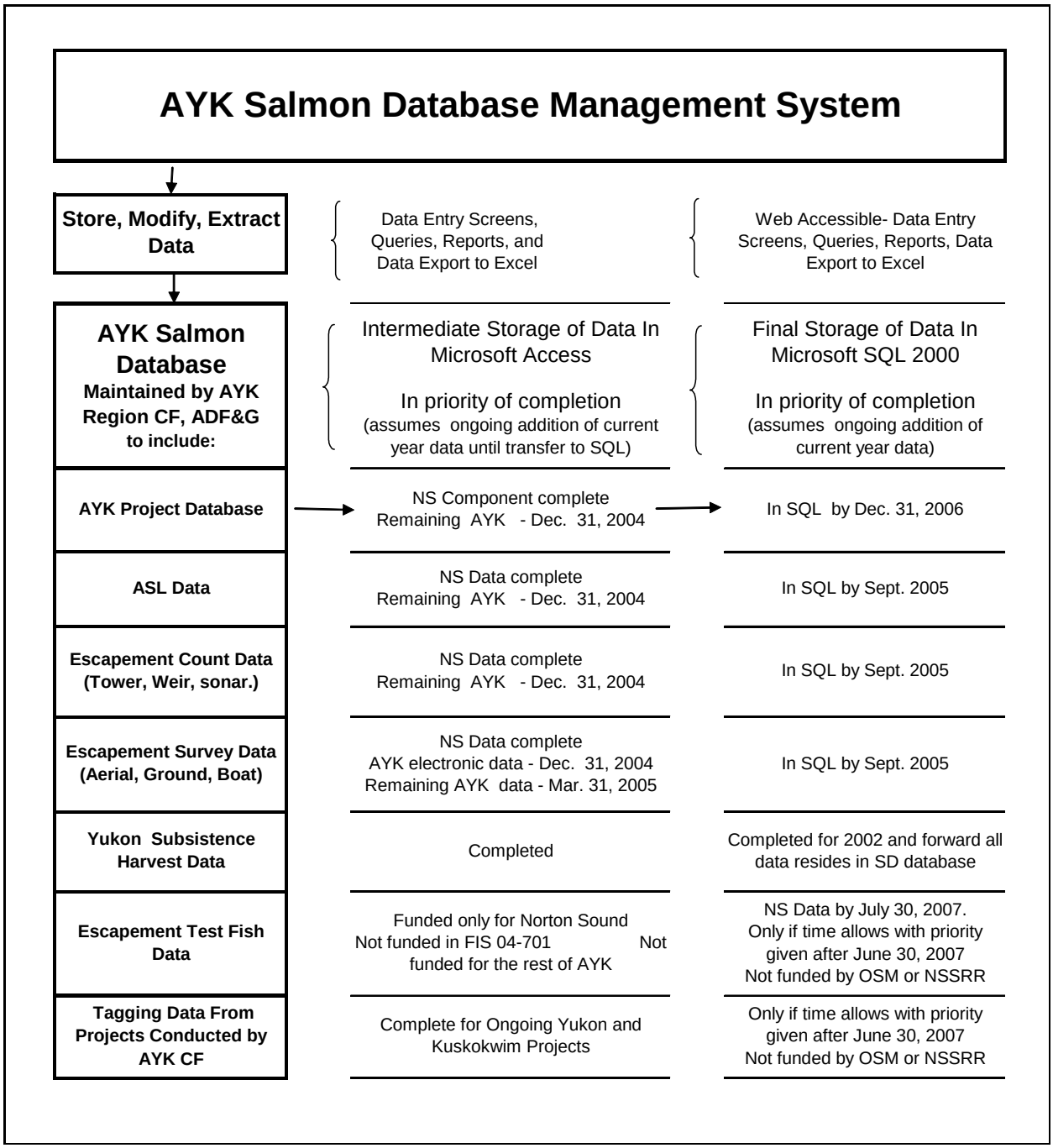


Figure 5. Priority and timeline for database components maintained by the Division of Commercial Fisheries AYK Region, September 2004.

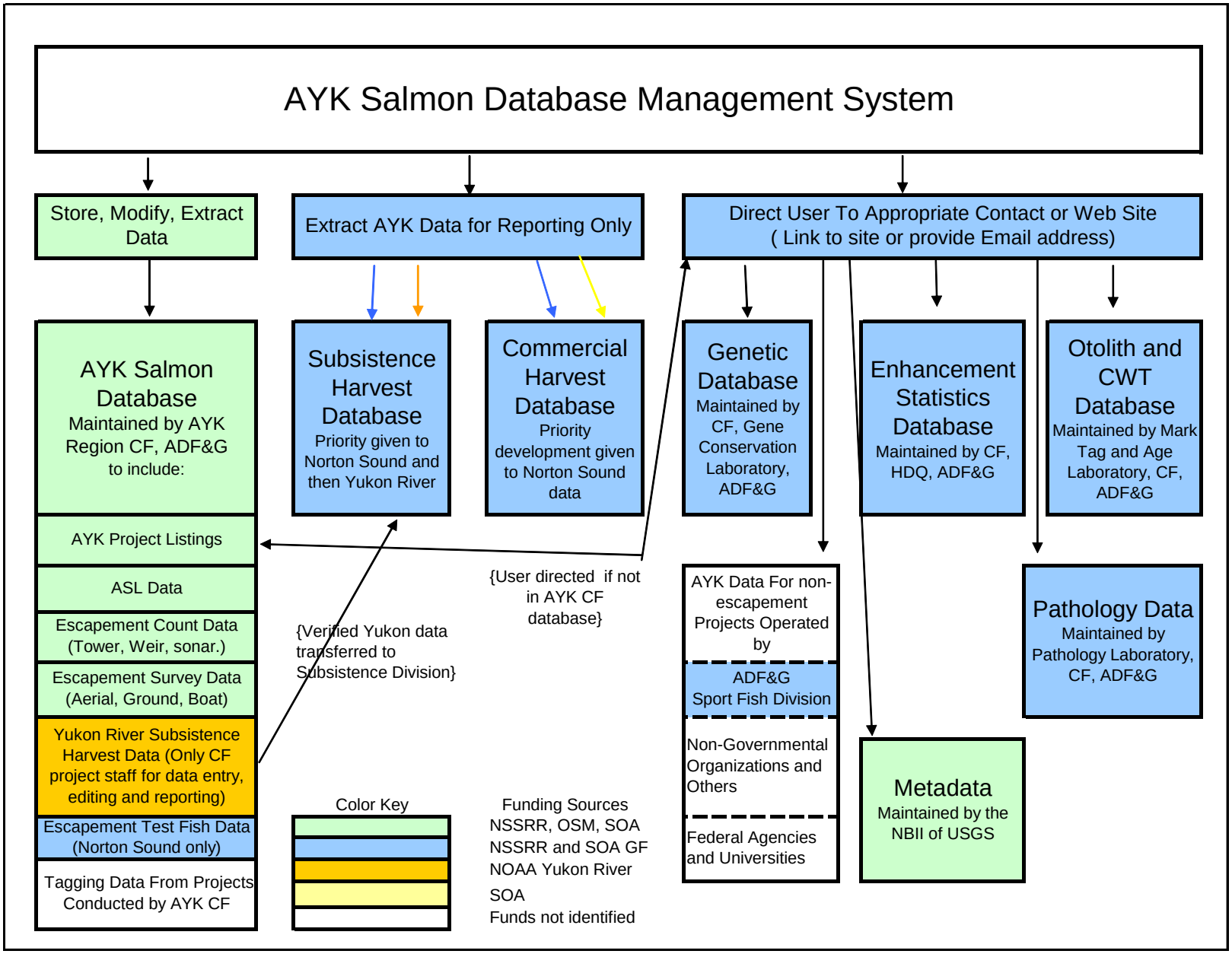


Figure 6. Funding source for components of the AYK salmon database management system.

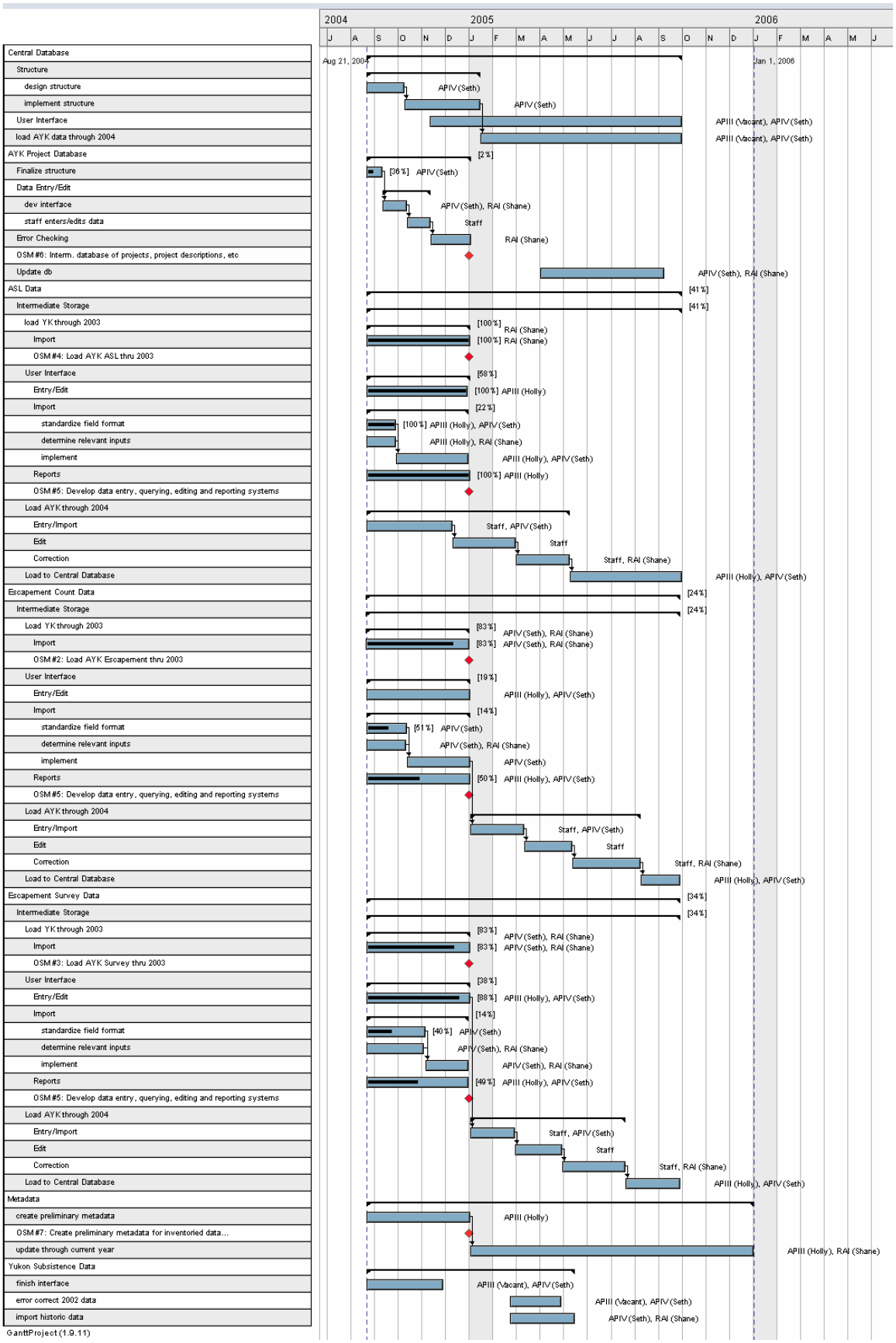


Figure 7. Task timeline and personnel assignments for development of the AYK salmon database management system.