

Special Publication No. 05-10

Development of the Arctic-Yukon-Kuskokwim Salmon Database Management System Through June 30, 2005

**Annual Report for Project 05-11, *Norton Sound Salmon Information Database*,
Norton Sound Salmon Research and Restoration Program and
Project FIS 04-701, *Develop Shared Fishery Database*,
USFWS Office of Subsistence Management, Fisheries Information Services Division**

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June 2005

Alaska Department of Fish and Game

Divisions of Sport Fish and Commercial Fisheries



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DATABASE MANAGEMENT SYSTEM THROUGH JUNE 30, 2005**

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June 2005

Development and publication of this manuscript was partially financed by the NOAA Cooperative Agreement NA16FW1272 for Project 05-11 Norton Sound Salmon Information Database and USFWS Cooperative Agreement 701814J580 for project FIS 04-701.

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This document should be cited as:

Brannian, L. K., S. Darr, H. A. Krenz, S. StClair, and C. Lawn. 2005. Development of the Arctic-Yukon-Kuskokwim salmon database management system through June 30, 2005. Alaska Department of Fish and Game, Special Publication No. 05-10, Anchorage.

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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 (ASL), escapement data, and Norton Sound test fisheries data through an Internet site. Extraction and reporting through the Internet of subsistence and commercial harvest data will also be completed for Norton Sound by June 30, 2007. This report represents an annual report for two projects providing funding support. It is the third year of funding from the Fishery Disaster Relief Program for Norton Sound (NOAA NA16FW1272) which supports Norton Sound components of the AYK salmon DBMS and the first year of funding from the United States Fish and Wildlife Service, Office of Subsistence Management for project FIS 04-701. During this period Microsoft Access and SQL databases were populated with AYK data through 2004 representing ASL measurement data, escapement count data (weirs, towers, sonar), and escapement survey data (aerial, foot, or boat). A scope of work for the AYK salmon DBMS was completed in September 2004. Data entry, editing, and reporting systems developed to date were demonstrated to users November 2004 and February 2005 and modifications to the system are being made based on user response. A project listing database was created and metadata records were completed. Data have been distributed to researchers upon request.

Key words: Arctic, Yukon, Kuskokwim, Norton Sound, database management system, metadata, salmon, ASL, escapement

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), the Alaska Department of Fish and Game (ADF&G) general funds and other federal grants, specifically the Norton Sound Salmon Research and Restoration fund (NSSRR), 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 users) and Federal (federally qualified subsistence users only) staff. 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) Kuskokwim, (2) Yukon, (3) Norton Sound/Port Clarence, and (4) 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.

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 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 1 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 from March 15, 2002 to January 31, 2003 was used to continue organizing historical data (Hamner et al. 2003a) and project FIS 04-701 for the period from July 1, 2004 to June 30, 2007 will be used to complete the database management system (Brannian et al. 2004).

The Steering Committee for the NSSRR fund approved a 5 year project (from July 1, 2002 to June 30, 2007)¹ 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 age, sex, and length (ASL) electronic files for Norton Sound salmon were aggregated and transferred to modern storage media. In the second year (Brannian et al. 2005), Access databases were populated with Norton Sound and Kotzebue data through 2003 representing ASL measurement data, escapement count data (weirs, towers, sonar), and escapement survey data (aerial, foot, or boat). Although these funds are allocated specifically for Norton Sound, applications and database structures developed for the Norton Sound area will be used for other areas of the region since data collection follows a standard protocol across the region. A single database is being developed.

¹ Funding is approved each year based on fulfillment of annual project objectives.

Additional funding was requested after discovering a significant number of ASL electronic files had been lost as a result of changes in staff and degradation in aging electronic media. In response, 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).

GOAL AND OBJECTIVES FOR THE AYK SALMON DATABASE MANAGEMENT SYSTEM

The AYK salmon database management system (DBMS) is currently supported by two projects. The Norton Sound Salmon Research and Restoration fund supports Project 05-11 *Norton Sound Information Database* and beginning July 1, 2004 the USFWS OSM approved funding for project FIS 04-701, *Develop Shared Fishery Database* which will help complete the AYK salmon DBMS. Each project specifies annual objectives and deliverables for the components they fund. The overall goal and objectives for the AYK salmon DBMS are:

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 Division of Commercial Fisheries.

Specific objectives were funded for completion by the Norton Sound component of the AYK salmon DBMS for the period from July 1, 2004 to June 30, 2005. These objectives represent project 05-11, *Norton Sound Information Database* as described by Brannian et al. (2005) and include:

1. Presentation of intermediate database systems (queries, reports, editing, and data entry capabilities), preliminary metadata structure, and project database to users and collect comments.

2. Complete IT review of project listing database, prepare reports which present all available data, send to project biologists for review.
3. Enter escapement count, aerial survey, and ASL data from 2004 into the intermediate Access database and corrections from previous IT review.
4. Incorporate Norton Sound test fish data through the current year into intermediate database.
5. Development of integrated central database with preliminary data entry, editing, querying, reporting and downloading capabilities; will begin January 1, 2005 and be working towards an end product due August 31, 2005.

Specific objectives were funded by USFWS OSM for completion during the period from July 1, 2004 to June 30, 2005. These objectives represent the first year of project FIS 04-701, *Develop Shared Fishery Database* and include:

1. Complete a scope of work for the AYK salmon database management project. Scope of work will include the relationship of intermediate databases to the final central database and plan for Internet accessibility. In addition, the Scope of work will clearly delineate the portion funded by this agreement, the data sets to be included, and timeline for completion for overall project components.
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 descriptions.
7. Create preliminary metadata for inventoried data according to standards for biological dataset by the National Biological Information Infrastructure (NBII), a division of the U. S. Geological Service (USGS), as required in all federally funded projects.
8. Present intermediate database systems (queries, reports, editing, and data entry capabilities), preliminary metadata structure, and project database (see Objectives 5–7) to users and collect comments.
9. Enter aerial survey data for the years that were not available in electronic form through 2004, into intermediate databases created in 2004 (Objective 3).
10. Standardize and error check escapement count data residing in intermediate databases created in 2004 (Objective 2); enter 2004 escapement count data.

AYK SALMON DATABASE MANAGEMENT SYSTEM

OVERVIEW

The AYK salmon DBMS is being developed to 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 salmon DBMS but maintained by ADF&G and/or listed as an AYK project in the AYK salmon DBMS will receive either a contact email address or web site link.

Six datasets maintained by AYK region CF staff were of high enough priority to be included in the AYK salmon DBMS. The datasets included (1) AYK project listing, (2) ASL data, (3) escapement count data from towers, weirs, and sonar, (4) escapement survey 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 non-confidential data². 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 salmon DBMS users and are not currently web accessible. Both commercial and subsistence harvest data reside in client-server SQL compatible salmon DBMS accessible by the AYK salmon DBMS. Users of the AYK salmon 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 after July 1, 2007.

The AYK salmon 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 salmon DBMS is being built in two steps; (1) data initially stored and maintained in intermediate databases created in Microsoft Access³ 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 that started this project are knowledgeable in Access and it possessed features useful to the intermediate process of data aggregation and standardization. Each data set resides in its own Access database and can be run from personal computers not necessarily connected by

² Examples of confidential data are an individual's commercial or subsistence harvest.

³ Product names used in this report are included for scientific completeness, but do not constitute a product endorsement.

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 (inseason) 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 a 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 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) were 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 Division of Commercial Fisheries local area network in Anchorage.

COMPUTER SOFTWARE REQUIREMENTS

Under NSSRR, much of the core software has been purchased for the development of the AYK salmon DBMS (Table 1). Microsoft Visual Studio .NET Professional 2003 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 was purchased to (1) provide adequate license coverage and (2) take advantage of the many enhancements in 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 was upgraded to the 2003 version for work with ADPs. A 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. Spatial Metadata Management System (SMMS) Version 5.1 was also purchased to develop AYK metadata.

INTERNET ACCESSIBILITY

The AYK salmon DBMS will be accessed through an ADF&G Internet site maintained by AYK Region staff. Though Internet accessibility of the AYK salmon DBMS is a 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, 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 because a connection to the State's WAN is unavailable. 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 data query 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 through 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 is the most developed and 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 independent of 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 a 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 Emmonak and 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 staff are satisfied with all group and individual levels of access and functionality will the site be made public, this will need to occur by June 30, 2007.

AYK SALMON DATASETS

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. Data from all commercial landings made in the region's salmon fisheries since 1969, consisting of over 9 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. Biological information has been collected for over 40 years from harvests and escapements to estimate the ASL composition of these salmon populations.

AGE, SEX, AND LENGTH DATA

Salmon ASL data are collected annually from sampled commercial and subsistence harvests, 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 1 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 5 millimeters from mid eye to tail fork. 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 and stored in cabinets located in the Anchorage ADF&G office. Paper copies of ASL data are filed in the same location. 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 the electronic data have been lost.

The AYK salmon DBMS project has taken electronic storage of ASL data from thousands of separate computer files for each project-year to a single centralized Microsoft SQL database. ASL datasets were first inventoried (Hamner et al. 2002, 2003b, and 2004) and then any

corresponding electronic data files that could be found were aggregated on a file server (Hamner et al. 2003a). ASL data were then loaded into area-specific Access databases for Norton Sound, Yukon, or the Kuskokwim areas. When electronic files could not be found for certain project-years, paper data forms were scanned or hand keyed to recover data. Data inventory and recovery by this project has ended, but historic data when brought to us are added to the AYK salmon DBMS. All electronically available ASL data have been loaded. A single “banker’s” box of paper forms is left to be hand entered and represents Norton Sound chum, Kotzebue chum, Yukon River chum and coho salmon data for which electronic versions are not available.

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 the 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 *unpublished*; Poetter *unpublished*), 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)⁴, 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 the 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) and were also 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

⁴ 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>

Norton Sound, Kotzebue and Port Clarence areas. These data are maintained in separate spreadsheets for each surveyed stream with a total of over 100 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 that includes only AYK data resides with AYK programming staff. This database formed the model that the Access version of the intermediate AYK database for escapement data was built upon.

Incorporating all escapement observations collected in AYK into the AYK salmon DBMS is important to meeting project goals and objectives. Furthermore, editing and verifying the accuracy of those data must occur. Both steps are time consuming and entail a through search for data. Currently the Access database of AYK escapement data includes (1) escapement count data (tower, weirs, and sonar) previously in the SASPOP database, (2) escapement count data collected in AYK since creation of the SASPOP database (through 2004), and (3) aerial, ground, and boat survey data through 2004 for all of AYK. All data have been edited, errors noted, and corrections to the database are near completion. Still to occur is a thorough review by knowledgeable staff to ensure that no escapement projects are missing from the database.

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 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 the Division of Subsistence (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 the Division of Subsistence. The results from subsistence harvest survey projects are reported in Division of Commercial Fisheries annual management reports (Banducci et al. 2003; Vania et al. 2002; Ward et al. 2003) 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 the Division of Subsistence in Anchorage. As of yet, it is undecided 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 DBMS until such time a link with the Division of Subsistence is agreed upon and developed. Thereafter Yukon River data will reside only in the Division of Subsistence database.

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 Division of Subsistence to be included in their Alaska Subsistence Fisheries Database (Caylor and Walker 2003).

Data collected in 2003 and 2004 were entered into a Microsoft SQL database component of the AYK salmon DBMS. This component is being used to develop Internet access. Though currently in use behind the State's firewall, ADF&G staff in Fairbanks enter and extract data from the database through the Internet.

Subsistence harvest data accessible via the Internet from the Division of Subsistence 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 Division of Subsistence 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) 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 dating 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 of Commercial Fisheries.

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, 7 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 has been added to the AYK salmon DBMS during this scope of work as a deliverable of the NSSRR project (before June 30, 2005). This represents the test fish project operated in the mouth of the Unalakleet River since 1981. 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). The data either resides in spreadsheets or published reports. Data from a radio telemetry project for Chinook salmon in the Yukon River and spaghetti tagging projects for chum, sockeye, and coho salmon in the Kuskokwim River and chum salmon on the Tanana River reside in project specific Access databases and Excel spreadsheets maintained by ADF&G CF staff. Brannian et al. (2004) indicated that funds have not been secured to add these data to the AYK salmon DBMS. They also recognized this data type as a future DBMS component. 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 salmon 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 fisheries data in these databases through online reports. The AYK salmon DBMS will direct users interested in this data to the 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 salmon 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 archives data in individual files. These data will not be included in the AYK salmon DBMS. Project details will be in the project listing database and interested users will be provided with contact and address information.

The 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

The 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 ADF&G and other State and Federal authorities on fish disease issues. Disease data have been gathered on Chinook salmon throughout AYK (Ichthyophonous) and in all salmon associated with enhancement activities. Data from these projects will not be stored in the AYK salmon DBMS. Project name, location, and other pertinent data will reside in the project database. Users of the AYK salmon DBMS interested in this data will be directed to the appropriate web site or contact email address.

PROJECT LISTING DATA

The idea of a project listing database grew out of the initial inventory prepared by Hamner et al. (2002 and 2003a). We thought it useful to have descriptive data for escapement count, escapement survey, test fishing, commercial and subsistence monitoring, age-sex-length sampling, mark-recapture, radio telemetry, tagging, enhancement, and other projects that have been conducted in AYK and are of interest to users of the AYK salmon DBMS. The database was initially created as a merging of the data inventory spreadsheet prepared by Hamner et al. (2002 and 2003a) with a table within the escapement database listing all escapement projects. The database has been expanded to reflect data recovery progress in ASL and updated to include projects since 2000. The project listing database functions as a source of metadata for the AYK salmon DBMS.

We developed a three tiered data structure for the project listing database and included features uniquely requested for Norton Sound. The first layer contains general project information such as project name, type, management area, and description. The second layer contains specific site locations (some projects move and therefore have multiple coordinate sets), years of operation,

contact name, operating agency, and a specific site description. The third layer contains the actual data.

All AYK escapement projects in our inventory are now listed in the project listing database. At the present time the only raw data linked to the project database are escapement counts, but eventually all data in the AYK salmon DBMS (e.g. ASL, test fish, etc.) will be directly linked to the project listing. Other data maintained externally (commercial harvests, subsistence, etc.) will be referenced by these project tables. The project database was developed from an escapement only prototype, and consequently can only store point specific geographic data. The database will have to be altered in the future to incorporate polygonal geographic data which describes two dimensional study areas such as commercial fishing subdistricts and river drainages.

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 are literally "data about data". The National Biological Information Infrastructure (NBII) is a division of the USGS and 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) and will be posted to their website when finalized. AYK staff have attended a workshop conducted by NBII and purchased their recommended software, SIMMS version 5.1. Interim grouping levels for metadata have been developed. Grouping levels may change and more detailed information may be included each year until metadata are finalized in June 2007. We will not post metadata on the NBII website until that data are actually available through the AYK salmon DBMS. Information gathered to meet NBII metadata requirements will also be added to the extent applicable in our project listing database.

PROGRESS IN DEVELOPMENT OF THE AYK SALMON DBMS JULY 1, 2004–JUNE 30, 2005

During this reporting period we undertook tasks to fulfill objectives for the Norton Sound (Project 05-11) and the USFWS OSM (FIS 04-702) projects supporting completion of the AYK salmon DBMS. Tasks involved (1) development of a scope of work for the AYK salmon DBMS, (2) update of a database comprised of project description information and preparation of NBII compliant metadata, (3) modification of existing databases that were then populated with Norton Sound, Kotzebue, Kuskokwim, and Yukon Area's ASL and escapement data through 2004, (4) addition of a Norton Sound test fish database, (5) development of data entry, editing, and report applications for those databases, and (6) standardize and error check escapement count data currently in the DBMS. We also prepared presentations of the AYK salmon DBMS for users in Anchorage and Nome and extracted data in response to users' request.

SCOPE OF WORK FOR THE AYK SALMON DATABASE MANAGEMENT SYSTEM

We were tasked to complete a scope of work for the AYK salmon DBMS as funded by USFWS OSM (project FIS 04-701) and another for the Norton Sound Salmon Information Database project (04-11) as funded by NSSRR (Brannian et al. 2005). As the Norton Sound database is a component of the AYK salmon DBMS we prepared one document representing our intentions

for both projects. The scope of work included the relationship of intermediate databases to the final central database and a plan for Internet accessibility. In addition the scope of work clearly delineated the portion funded by the two agreements, the data sets to be included, and the timeline for completion of overall project components.

The scope of work captured our philosophy for the AYK salmon DBMS which was to emphasize data storage and retrieval. We do not plan to provide options for the user to request “reports” which produce tables that can be directly placed into AYK publications (ADF&G Fishery Data Series, Regional Information Reports, etc). Instead we are focusing on data entry features; edit screens, and reports from data queries. Data retrievals will be flexible allowing the user to export data for their own analysis and table formatting for publication. Database reports export data into Microsoft Excel or display data so users can review and suggest changes.

We do not want the AYK salmon DBMS to be redundant and strove to cooperate with other sections and divisions that manage AYK data. Those data types include commercial catch, subsistence harvest, genetics, limnology, and aquaculture/enhancement. Therefore we needed to determine if (1) we could develop queries that actually link to databases managed by other groups with AYK data as our first choice (for example fish tickets, subsistence harvest, or aquaculture/enhancement) or (2) instead would need to duplicate the data in our database or (3) develop a link to send the user over to another system for data retrieval.

A report (Brannian et al. 2004) was prepared which described the overall scope of work for development of a salmon database management system for the AYK Region. Tables and figures from that report have been updated to reflect progress since September 2004 and presented here to include: software and hardware components (Table 1), timeline for completion (Table 2), and personnel assignments (Table 3). As discussed in this report our scope of work also included: (1) an overview of all funding sources used thus far to develop the AYK salmon database management system (Figures 2 and 3), (2) the data components and level of access to be included (Figure 4), (3) the relationship of intermediate databases and the final central database (Figure 5), 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.

AGE, SEX, AND LENGTH DATA

The ASL component of the AYK salmon DBMS was the best developed to date. Prior to this reporting period much time had been spent locating ASL data, inventorying that data, developing an ASL database structure, and populating the database with available data. Programs were written and used to load data into the database. A data entry screen was developed for hand entry and a commercial firm employed to enter data from paper forms. During this reporting period five aspects of the ASL component of the AYK salmon DBMS were addressed; database maintenance, data entry/loading, data editing, application development, and data retrieval. Much of the work directed towards ASL data until now was funded by other projects (Figures 2 and 3).

Database maintenance involved development of the database structure for the final centralized database in Microsoft SQL. Area specific Access databases were merged and all data were transferred into the SQL database. The SQL database was subsequently modified to comply with divisional database standards recently agreed upon. These recent structural changes have been minor and future structural changes are unlikely.

Data entry and data loading continued into this reporting period. A new program was developed to recognize and parse each of the different ASL electronic file formats that result from various electronic data capture methods (OPscan forms, “data loggers”, electronic measuring boards, etc.) into a format that can be loaded into the SQL database. This effort allowed us to migrate from Microsoft Visual Basic 6 to .NET 2003 (Scope of Work standard) and conform to the new SQL database structure. All AYK data from 2004 and historic data from Norton Sound found during this reporting period were loaded. Paper forms from Norton Sound were also made available to us and were added to Yukon River chum and coho salmon ASL data previously recovered and represent what remains to be hand entered. The forms reside in a single “banker’s” box.

Editing of data during this reporting period involved both elements that we could accomplish without input from project biologists and elements involving project staff resulting from data requests. The database was searched for duplicate entries that were then deleted. Other gross error checking and correction of ASL data in Access and in SQL server was conducted. Each time applications were tested against the database and data errors were found they were noted and corrected. Data were modified to be in a consistent aging convention (European) and header information was checked and corrected. Data, hand entered by a private firm (Brannian et al. 2005), were checked for correct location, date, and ages and were converted to European ages. The Norton Sound and Yukon Chinook salmon segments of the ASL database have had thorough preliminary editing. For other areas-species combinations, some codes still need to be standardized. Next biologists, project leaders, and users of these data need to be drawn into the editing process.

Applications in Access were developed to enter, edit, and extract ASL data from our database. Queries were built which could create data summaries and inventories directly from the database. Specifically an ASL inventory report was developed in Access which includes the number of salmon of each species by year, project, and location. The SQL database is edited, queried, and reported through Access. An Access front end for inseason data entry and editing has also been developed. These applications were presented to users November 2004 and February 2005. After each demonstration suggested changes were noted and are being incorporated. A standalone Access version for use inseason at locations remote from the Internet are developed and scheduled for use in Emmonak and Unalakleet June 2005.

Several requests for data or enquires of the availability of data have been received. Researchers looking at the effects of net selectivity on size of fish over time have requested Yukon Chinook ASL data. Researchers looking at trends in marine growth in Bering Sea salmon requested scale impressions and accompanying electronic ASL data. Researchers have also enquired about the availability of ASL data from Yukon River tributaries in Canada and ASL data from Norton Sound tributaries. Working with the associated AYK project biologists we edited and then retrieved verified data for them to fulfill these requests.

At the time of publication approximately 3,791 files of ASL data are thought to exist where each file represents a year, species and project combination (Table 4). A file’s existence was based on reference in reports, availability of scale cards, paper records or as inventoried by Hamner et al. (2002, 2003b). Recently 241 (3,791–3,550) additional files were brought to our attention increasing the total number of files we think were collected. A total 426 (3,212–2,786) files were added since Brannian et al. (2005) reported representing files that were previously noted as “missing” or files that had not been loaded. Corrections to the database (elimination of

duplicates, corrected species codes, etc.) also account from the difference in Table 4 from that reported by Brannian et al. (2005). Of that estimated total 92.2% or 3,497 files have been located and 91.9% or 3,212 files have been loaded into the AYK salmon DBMS, SQL database. Coverage varies by species and area, with the greatest recovery occurring for the Kuskokwim and Port Clarence areas (over 93%).

ESCAPEMENT DATA

During this reporting period four aspects of the escapement component of the AYK salmon DBMS were addressed; database maintenance, application development, data entry/loading, and data review. The component was presented to users in Nome and Anchorage and comments are being incorporated. Previously, data residing in the Access version of SASPOP were reviewed and all Norton Sound and Kotzebue escapement count (tower, weir, sonar, etc.) and escapement survey (boat, aerial, and foot) data through 2003 were loaded (Brannian et al. 2005). Programs were also written to load, edit, and extract data from this Access database.

Data entry and loading of existing escapement data included loading electronic data residing in other databases, residing in text files, Excel spreadsheet data, and hand entry from paper forms. Non-duplicative data were extracted from an RBase database with escapement count and survey data from the mid-1980s to late 1990s maintained by Burkey and Salomone (1999). Fairbanks ADF&G staff also kept an Access database developed from SASPOP and from which recent data were extracted (1999–2000). Escapement count data collected since Burkey and Salomone (1999) through 2004 were loaded from Excel spreadsheets maintained by Kuskokwim ADF&G staff. Escapement count data for the Yukon River were loaded from Excel spreadsheets representing the most recent versions of the Yukon salmon “spread webs” (B. Borba, Fairbanks and S. Hayes, Anchorage, ADF&G, personal communication). Text files were found and loaded representing early aerial survey data from the Kuskokwim and Yukon (Barton 1984) Rivers retrieved from a now obsolete Honeywell mainframe computer. More recent survey (aerial, ground, and boat) data were added to the AYK database by hand entry from paper survey forms stored in Anchorage, Fairbanks, and Bethel ADF&G offices. All known escapement survey data from 1953 through 2004 now reside in the AYK salmon DBMS (Table 5). A total of 525 locations (rivers, streams, or lakes) have been surveyed in the AYK region accounting for over 2,300 counts of Chinook and chum salmon (Appendix A1). Escapement count data from 71 tower, weir, or sonar projects from 1965 through 2004 representing 55 rivers or streams (Table 6) also now reside in the database (Appendix A2). During a recent comparison of the project listing database and our escapement count database we found 85 project-year combinations missing data. Most of these data are from projects operated in the Canadian portion of the Yukon River and these data are being requested through the Joint Technical Committee in support of the U.S. Canada Treaty for Yukon River Salmon. Most notable are 45 years of Chinook salmon counts from the counting tower at the Whitehorse Fishway (1959–2004). Throughout AYK data from discontinued projects later found to poorly represent abundance will not be loaded. Examples include the Unalakleet River sonar project, 1983–1985 and the Kwethluk River sonar project, 1978–1979 (Appendix A2).

Data review and correction involved two steps, correcting previously noted errors and reviewing recently loaded data. Brannian et al. (2005) reported that data residing in the AYK salmon DBMS had been compared to their original source and errors had been noted. During this reporting period those errors were corrected. Additionally recently loaded data were also compared against their source, errors noted, and corrected.

NORTON SOUND TEST FISH DATA

During this reporting period an additional component was added to the AYK salmon DBMS to store Norton Sound test fish data. A database was designed to store general test fish project data including catch, effort, and catch per unit effort information. Data from Norton Sound was then loaded from spreadsheets. The Norton Sound project loaded represent a test fish project operated in the mouth of the Unalakleet River annually since 1981 using set gillnets to index run strength and timing of migrating salmon (Hamner et al. 2003b).

This database was created with all AYK test fish data in mind. Per our scope of work Yukon and Kuskokwim test fish data will be added as time allows or after 2007. It is not an objective of the Norton Sound or OSM projects. Data from a Kotzebue test fish project operated in the lower portion of the Kobuk River are being loaded in the AYK salmon DBMS.

PROJECT LISTING DATABASE

During this reporting period the project database in Access (Brannian et al. 2005) was (1) updated to include projects started since the data inventory was completed by Hamner et al. (2002, 2003a), (2) reviewed for completeness with the addition of some projects noted in Hamner et al. (2002), (3) presented to AYK staff, and (4) reports by area sent to area and project biologist for their final review and edit. The database now consists of 188 projects (Table 7) beginning in 1960. Information for each project includes project name, description, years of operation, contact person, agency, and division (Appendix B1).

METADATA

In order to meet the minimal metadata requirements according to the Federal Geographic Data Committee (FGDC) Standard 001.1-1999 of NBII Division of USGS, information was needed to complete sections one and seven of the Biological Data Profile. Section one is identification information and includes citation, description, time period of content, status, keywords, taxonomy, bounding coordinates, access constraints and use constraints. Section seven is metadata reference information and the mandatory portions are metadata date, metadata contact, metadata standard time, metadata standard version.

A preliminary metadata structure was developed for use in 2005 (Appendix C1). Metadata structure for ASL and escapement data represents grouping by area (Kuskokwim, Yukon, Norton Sound/Port Clarence, or Kotzebue) and species. Contact information will remain quite general and represent a position rather than an individual's name (i.e. AYK Regional Research Biologist). Taxonomic information was downloaded from the MBII metadata Internet site. A metadata questionnaire was sent to each area research biologist (Appendix C2). Completed forms are being returned and entered using SIMMS version 5.1 software.

PRESENTATION TO USERS AYK SALMON DBMS

The AYK salmon DBMS was presented to invited users February 18, 2005. Invitations were sent to agency and cooperative research groups whose data are being included in the DBMS. Notes were taken of the meeting and a number of suggestions from users were incorporated into the system during this reporting period. Highlights of the meeting were the commitment to collect data in a standardized manner, formation of subcommittees to facilitate the standard use of codes and forms. Those present were also enthusiastic and committed to the creation of usable and detailed metadata.

DISCUSSION

Objectives for the period from July 1, 2004 to June 30, 2005 of the Norton Sound Information Database project and USFWS OSM Shared Fishery Database project were fulfilled. A scope of work was completed (Brannian et al. 2004), databases were populated with ASL and escapement data through 2004, a project listing database was developed, and metadata for the AYK salmon DBMS was created. Data entry, editing, and reporting systems were developed and escapement data were rechecked for errors. Data have been distributed to researchers upon request, and the AYK salmon DBMS has been demonstrated to users in Anchorage (February 2005) and Nome (November 2004).

Through development of our scope of work we have tried to address the issue of multiple projects funding one goal, the development of the AYK salmon DBMS. This report documents our progress in developing the AYK salmon DBMS reported annually, in one document, as a draft progress report in December and the final in May. We have tried to make sure each participating agency is aware of how their funded project supports overall progress and how their annual objectives are being met and compare to others. We intend to continue to develop one annual report satisfying reporting commitments for the two current sources of funding, NSSRR and USFWS OSM.

The ASL database has become an asset to the region. Though project resources are no longer being expended in rescue and recovery, other project leaders are bringing data, not previously included, to our attention. Data retrievals are saving project leaders time responding to data requests. Every opportunity to query the database is used to edit and verify data. IT staff have used the development and testing of applications as an opportunity to further verify the data. Additional funds have been sought and granted to hire seasonal technicians to verify and correct as necessary all Yukon River data.

Though metadata has not been completed for this project substantial progress has been made in training, software choice, and development of a framework and questionnaire. Preliminary metadata developed around our initial framework was completed by December 31, 2004 as a deliverable for the OSM funded component of the AYK salmon DBMS (Table 2). Metadata should not be considered complete prior to the end of this project, but will be updated annually. The complexity and detail provided in a metadata record may increase as we understand how it will benefit our users. Additionally it is questionable whether Metadata posted for general viewing should occur prior to the underlying data being available through the Internet (goal for June 30, 2007). Metadata will be addressed every year as an objective and presented to users annually for comment. An updated copy of the metadata will be included in the 2006 annual report.

Though all AYK data have been loaded into either intermediate Access databases or a centralized SQL database editing by project biologists (or their designees) still needs to occur. We have conducted routine scans for out of range values and duplicate data; have standardized codes and filled in missing record fields; and made corrections to loaded data that we felt necessary. Reports have been created to display data such that project leaders can compare query results from the database with their published reports, spreadsheets, or paper forms. We expect project biologist review to occur and have set an objective of June 30, 2005 for escapement count data, August 31, 2005 for survey data and ASL data. Norton Sound data will be included in the review of all AYK salmon data.

Data standardization and coordination among researchers is also an important issue to address. Throughout this project we have met with staff to stress usage of standard codes, formats, etc. We have also participated in an interagency data standards committee for ASL data. The State recently developed an IT plan for which this project was recognized. IT staff responsible for subsistence and commercial harvest data have committed to work with us to complete linkage between databases, per our scope of work. A significant outcome of our February presentation was a commitment of attending staff to the collection of standardized data.

We have met and been in consultation with researchers interested in AYK salmon data. A fishery biologist for the University of Alaska Fairbanks in his joint working capacity for the Bering Sea Fisherman's Association requested a copy of our scope of work and is interested in obtaining ASL data. We met with the fishery biologist employed by Kawerik, Inc. to demonstrate the current state of development of the AYK Salmon DBMS with emphasis on Norton Sound data. ASL data have been extracted from the database for use by researchers employed by USGS, Natural Resources Consultants, Inc, and ADF&G biologists in Nome and Juneau. Our scope of work document has been sent to Information Technology staff with the Division of Subsistence of ADF&G and Division of Commercial Fisheries Computer Services Section in Juneau. This project has been discussed at all ADF&G post season staff meetings with emphasis on issues of data standardization and editing.

CONCLUSIONS FOR NORTON SOUND INFORMATION DATABASE (05-11) OBJECTIVES

We conclude the following for the July 1, 2004 through June 30, 2005 objectives for the Norton Sound Information Database (05-11) project:

1. *Presentation of intermediate database systems (queries, reports, editing, and data entry capabilities), preliminary metadata structure, and project database to users and collect comments.* This objective was fulfilled on February 18, 2005, when the AYK salmon DBMS was presented to ADF&G, USFWS, and Norton Sound Scientific Technical Committee members present at the USFWS Conference room in Anchorage. A presentation on project objective fulfillment and AYK salmon DBMS status was also made to the Norton Sound Research and Restoration steering Committee in Nome on January 17, 2005.
2. *Complete IT review of project listing database, prepare reports which present all available data, send to project biologists for review.* This objective was fulfilled. Reports have been sent to Norton Sound project biologists and other knowledgeable biologists. Reviews have been received back from ADF&G Nome Area biologists and have been incorporated into the database.
3. *Enter escapement count, aerial survey, and ASL data from 2004 into the intermediate Access database and corrections from previous IT review.* This objective was fulfilled. Data through 2004 are now loaded and verified.
4. *Incorporate Norton Sound test fish data through the current year into intermediate database.* This objective was completed. Project data were sent to IT staff and a preliminary database developed to store these data.
5. *Development of integrated central database with preliminary data entry, editing, querying, reporting and downloading capabilities; will begin January 1, 2005 and be working towards an end product due August 31, 2005.* Progress has been made with this objective and we are

satisfied that fulfillment will be achieved by August 31, 2005. Applications added during this project year include a data entry screen for escapement survey data. Enhancements were also made to the set of data entry, editing, querying, and reporting applications in response to user comments during our demonstration to Nome staff in November 2004 and AYK ADF&G and others in February 2005.

CONCLUSIONS FOR DEVELOP SHARED FISHERY DATABASE (FIS 04-701) OBJECTIVES

We conclude the following for the July 1, 2004 through June 30, 2005 objectives for the Shared Fishery Database project (FIS 04-701):

1. *Complete a scope of work for the AYK salmon database management project.* This objective was fulfilled by Brannian et al. (2004).
2. *Load daily escapement counts (from weirs, towers, sonar, etc.) for salmon in the AYK region, to include years through 2003, into intermediate databases.* Objective fulfilled for readily available data. Canadian Yukon data have been requested.
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.* This objective was fulfilled.
4. *Load ASL data for salmon in the AYK region, to include years through 2003, into intermediate databases.* This objective was fulfilled and in addition data reside in the final SQL database.
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.* This objective was fulfilled though work continues to incorporate users comments other identified enhancements.
6. *Develop an intermediate database of projects, project descriptions, lead agencies, years of operation, data collected, and electronic data descriptions.* This objective was fulfilled and all known projects have been added and the project listing is under review.
7. *Create preliminary metadata for inventoried data according to standards for biological dataset by the National Biological Information Infrastructure (NBII), a division of USGS, as required in all federally funded projects.* This objective was fulfilled.
8. *Present intermediate database systems (queries, reports, editing, and data entry capabilities), preliminary metadata structure, and project database (see Objectives 5–7) to users and collect comments.* The AYK salmon DMBS was presented to interested users on February 19, 2005, notes were taken and summarized.
9. *Enter aerial survey data for the years that were not available in electronic form through 2004, into intermediate databases created in 2004.* Objective fulfilled.
10. *Standardize and error check escapement count data residing in intermediate databases created in 2004 (Objective 2); enter 2004 escapement count data.* Objective fulfilled for readily available data. Canadian Yukon project data have been requested.

RECOMMENDATIONS

We recommend the following:

1. Adoption of the scope of work (Brannian et al. 2004) for the AYK salmon DBMS by the Norton Sound Salmon Research and Restoration fund and USFWS OSM.
2. Continued development of one annual report documenting the progress in developing the AYK salmon DBMS and satisfying the reporting requirements for the Norton Sound and USFWS OSM projects.
3. Incorporate user comments from the February 2005 presentation into the AYK salmon DBMS.
4. Continue work to edit and verify data. Verify that data missing from the database are either from Canadian Yukon projects or represent data from projects later found to not represent abundance and would therefore not be loaded into the AYK salmon DBMS.

ACKNOWLEDGEMENTS

The National Oceanic and Atmospheric Administration under Cooperative Agreement NA16FW1272 for Research and Prevention Relative to the 1999 Norton Sound Fishery Disaster provided \$44,608 in funding support for this project (05-11 *Norton Sound Salmon Information Database*). The USFWS OSM provided \$75,000 in funding support to ADF&G for project FIS 04-701 through the Fisheries Resource Monitoring Program, under agreement number 701814J580. We thank Chris Sheldon for checking escapement data, scanning data sheets, and keying data. We thank Hamachan Hamazaki, Carmine DiCostanzo, and Katie Sechrist for reviewing this document. Helen Hamner, retired ADF&G, should be recognized for her foresight in initiating this project and persistence in securing funding for development of the AYK salmon database management system. Aggregation and rescue of AYK data would not have occurred without her persistence and dedication to the task.

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TABLES AND FIGURES

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

Equipment purchased under the NSSRR project ^a:

Web/database server

- Dell PowerEdge 2600 w/2GHz processor, 1GB 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 purchased under project FIS 04-701 and SOA ^b funds:

Web server

- Dell PowerEdge 2850 w/3.2GHz processor, 2GB RAM, 36GB hard drive, running Windows 2003 Server Standard Edition Database server
- Dell PowerEdge 2850 w/3.4GHz processor, 8GB RAM, two 146GB hard drives in a RAID 1 configuration, running Windows 2003 Server Enterprise Edition
- Software
- Microsoft Visual Studio .NET Professional 2003
- Microsoft Access 2003 (as part of Office 2003)

^a NSSRR project is funded by the Norton Sound Salmon Research and Restoration fund.

^b 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 and the USFWS Office of Subsistence Management.

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
<p>July 1, 2002–June 30, 2003:</p> <ol style="list-style-type: none"> 1. Create an inventory of existing data sources, (see <i>Norton Sound Salmon Information Database, File Inventory and Problem Review, RIR 3A03-01</i>). 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. 	
<p>July 1, 2003–June 30, 2004:</p> <ol style="list-style-type: none"> 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 geo-referenced 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 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. 	<p>August 1, 2004–December 31, 2004:</p> <ol style="list-style-type: none"> 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 descriptions. 7. Create preliminary metadata for inventoried data according to standards set by the National Biological Information Infrastructure.

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<p>Norton Sound Salmon Research and Restoration Project:</p>	<p>USFWS Office of Subsistence Management Project:</p>
<p>Norton Sound Salmon Information Database</p>	<p>FIS 04-701 Develop Shared Fishery Database</p>
<p><i>July 1, 2004–June 30, 2005:</i></p> <ol style="list-style-type: none"> 1. Presentation of intermediate database systems (queries, reports, editing, and data entry capabilities), preliminary metadata structure, and project database to users and collect comments. 2. Complete IT review of project listing database, prepare reports which present all available data, send to project biologists for review. 3. Enter escapement count, aerial survey, and ASL data from 2004 into the intermediate Access database and corrections from previous IT review. 4. Incorporate Norton Sound test fish data through the current year into intermediate database. 5. Development of integrated central database with preliminary data entry, editing, querying, reporting and downloading capabilities; will begin January 1, 2005 and be working towards an end product due August 31, 2005. 	<p><i>January 1, 2005–December 31, 2005:</i></p> <ol style="list-style-type: none"> 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.

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<p>Norton Sound Salmon Research and Restoration Project:</p>	<p>USFWS Office of Subsistence Management Project:</p>
<p>Norton Sound Salmon Information Database</p>	<p>FIS 04-701 Develop Shared Fishery Database</p>
<p><i>July 1, 2005–June 30, 2006:</i></p> <ol style="list-style-type: none"> 1. Development of integrated central database with preliminary data entry, editing, querying, reporting and downloading capabilities incorporating comments from February 2005 presentation. 2. Population of central database with escapement count, aerial survey, Norton Sound test fish, and ASL data from intermediate databases; September 30, 2005. 3. Update of metadata to account for additions to the database management system in 2005 and user comments. 4. Update of intermediate project database to account for additions to the database management system in 2005 and project biologist review comments. 5. Presentation of central database system (preliminary queries, reports, editing, and data entry capabilities), updated metadata, and updated intermediate project database to users and collect comments. 6. Entering of escapement count, aerial survey, and ASL data from 2005 into the central database. 7. Enhancement of data entry, editing, querying, and reporting components of the central database of the AYK salmon database management system and response to comments collected through Objective 5 above; will begin February 16, 2006 and be working toward an end product due August 31, 2006 (see 07-11). 	<p><i>January 1, 2006–December 31, 2006:</i></p> <ol style="list-style-type: none"> 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 downloads through the web) to users and collect comments.

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<p>Norton Sound Salmon Research and Restoration Project:</p>	<p>USFWS Office of Subsistence Management Project:</p>
<p>Norton Sound Salmon Information Database</p>	<p>FIS 04-701 Develop Shared Fishery Database</p>
<p><i>July 1, 2006–June 30, 2007:</i></p> <ol style="list-style-type: none"> 1. Enhancement of data entry, editing, querying, and reporting components of the central database of the AYK salmon database management system and response to comments collected through Objective 1 in 2006. 2. Development of data extraction and reporting for Norton Sound subsistence and commercial harvest data. 3. Transferring of data from the intermediate project database (currently in Access) to the central AYK salmon database. 4. Development of web access to central database for AYK salmon. 5. Presentation of web accessibility to the central database system (ability to conduct data entry, queries, reports, and downloads through the web) to users and collect comments. 6. Enhancement of web accessibility to the central database system (queries, reports, editing, and data entry capabilities); respond to user comments from 2006. 7. Entering of escapement count, aerial survey, and ASL data from 2006 into the central database through the web. 8. Provide access to the AYK database management system web site to ADF&G users for testing. 9. Finalize metadata. 10. Provide public access to the web site for the AYK database management system, June 30, 2007. 	<p><i>January 1, 2007–June 30, 2007:</i></p> <ol style="list-style-type: none"> 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.

Table 3.—Personnel in AYK’s Information Technology unit assigned to develop the AYK salmon DBMS in coordination with their Regional Research Supervisor.

ADF&G AYK Information Technology Staff
<p>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. Seth will take the lead in development of the SQL central database and web accessibility. He is also responsible for the Yukon River subsistence harvest data component.</p>
<p>Holly Krenz (formerly 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. Holly is responsible for the ASL and metadata components of the AYK salmon DBMS.</p>
<p>Shane StClair is a Research Analyst 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 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 OSM project FIS 04-701 for AYK salmon DBMS duties. Shane will be responsible, with programming support from Seth, for the project listing database, web-clickable maps, and will assist loading and editing of escapement and ASL data. He will supervise technicians hired to hand enter or edit data.</p>
<p>Christopher Lawn is a recently hired AP II scheduled to begin work on the AYK salmon database management system December 27, 2004. Christopher is a recent graduate of UAA with a degree in Management Information Systems. Christopher is funded by NSSRR, project FIS 04-701, and SOA general funds. Under direction from Seth Darr, Christopher will help develop and maintain the SQL central database and provide web accessibility.</p>
<p>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.</p>

Table 4.—Estimated number and status of age, sex, and length files by area and salmon species for the AYK Region, December 10, 2004.

AYK ASL Inventory Summary								
<i>Area</i>	<i>Species</i>	<i>Years</i>	<i>Approximate Total Number of Files</i>	<i>In Database</i>	<i>To be added</i>	<i>Missing Files</i>	<i>% Found ASL Data Loaded Into Database</i>	<i>% Total Estimated ASL Data Recovered</i>
Kuskokwim	Chinook	1964-2004	315	290	3	22	99.0%	93.0%
	Chum	1964-2004	305	274	12	19	95.8%	93.8%
	Coho	1961-2004	194	187	0	7	100.0%	96.4%
	Sockeye	1964-2004	213	195	3	15	98.5%	93.0%
	Pink	1968-1994	11	2	0	9	100.0%	18.2%
	Total Files			1038	948	18	72	98.1%
Yukon	Chinook	1960-2004	1003	873	75	55	92.1%	94.5%
	Chum	1961-2004	912	708	122	82	85.3%	91.0%
	Coho	1964-2004	181	139	26	16	84.2%	91.2%
	Sockeye	1979-1998	13	12	0	1	100.0%	92.3%
	Pink	1970	1	1	0	0	100.0%	100.0%
	Total Files			2110	1733	223	154	88.6%
Norton Sound	Chinook	1966-2004	114	86	22	6	79.6%	94.7%
	Chum	1962-2004	206	174	5	27	97.2%	86.9%
	Coho	1963-2004	89	83	1	5	98.8%	94.4%
	Sockeye	1979-2001	9	8	1	0	88.9%	100.0%
	Pink	1965-1978	13	0	12	1	-	92.3%
	Total Files			431	351	41	39	89.5%
Port Clarence	Chinook	1966-2003	3	2	0	1	100.0%	66.7%
	Chum	2002-2004	3	3	0	0	100.0%	100.0%
	Coho	2003-2004	2	2	0	0	100.0%	100.0%
	Sockeye	1963-2004	8	7	1	0	87.5%	100.0%
	Pink	-	0	0	0	0	-	-
	Total Files			16	14	1	1	93.3%
Kotzebue	Chinook	1978-1987	5	4	0	1	100.0%	80.0%
	Chum	1962-2004	181	155	2	24	98.7%	86.7%
	Coho	1984-1988	4	2	0	2	100.0%	50.0%
	Sockeye	1984-1989	4	4	0	0	100.0%	100.0%
	Pink	1978-1979	2	1	0	1	100.0%	50.0%
	Total Files			196	166	2	28	98.8%
Total ASL Files			3,791	3,212	285	294	91.9%	92.2%

Table 5.—Number of surveys (ground, boat, or aerial) with counts of salmon by stream and area in the AYK salmon database management system.

Area	Number of Locations	Range of Years ^a	Number of Surveys With Counts of ^c						
			Chinook	Chum	Coho	Pink	Sockeye	Unknown Salmon	No. Fish
Kotzebue	43	1960 – 2003 ^b	44	291	4	37	6	57	33
Kuskokwim	179	1959 – 2004	717	587	312	242	420	199	184
Norton Sound	51	1958 – 2004	401	579	272	529	63	112	71
Pt. Clarence	5	1961 – 2004	14	21	9	12	90	9	3
Yukon	247	1953 – 2004	1,173	1,109	397	109	78	688	222
Total	525	1953 – 2004	2,349	2,587	994	929	657	1,065	513

^a Represents the first and last year surveyed but not necessarily all years in between.

^b No surveys conducted in the Kotzebue area in 2004.

^c A survey may have counts of more than one species of salmon. The total number of years surveyed is less than the sum of the counts by species.

Table 6.—Number of escapement projects (weir, tower, sonar) with counts of salmon by area in the AYK salmon database management system.

Area	Number of Projects	Range of Years ^a	Number of Project-Years With Counts of						
			Chinook	Chum	Coho	Pink	Sockeye	Unknown Salmon	NID ^b
Kotzebue	2	1981 – 2003	0	7	0	6	0	1	2
Kuskokwim	18	1969 – 2004	120	134	96	64	115	6	3
Norton Sound	17	1965 – 2004	86	104	65	100	5	0	11
Pt. Clarence	2	1997 – 2004	5	4	5	5	4	1	0
Yukon	32	1972 – 2004	103	204	33	21	5	4	69
Total	71	1969 – 2004	314	453	199	196	129	12	85

^a Represents the first and last year surveyed but not necessarily all years in between.

^b Represents a project/year for which data have not been loaded into the AYK salmon DBMS (NID). Most are single year projects, projects discontinued after found unfeasible, or operated in the Canadian portion of the Yukon River (for which data have been requested).

Table 7.—Contents of the project listing database within the AYK salmon database management system, June 30, 2005.

Area	Project Type	Project Name	Years of Operation	Agency
Kotzebue	Aerial Survey	Kotzebue Aerial Surveys	1959 - Present	ADF&G
	Age-Sex-Length Sampling	Kotzebue Commercial Age-Sex-Length Sampling	1962- Present	ADF&G
	Catch and Effort Assessment	Kotzebue Commercial Catch and Effort Assessment	1960- Present	ADF&G
	Catch and Effort Assessment	Kotzebue Subsistence Catch and Effort Assessment	1960- Present	ADF&G
	Counting Tower	Squirrel River Tower	1982, 1984	ADF&G
	Mark/Recapture	Kotzebue Chum Salmon Tagging	1966 - 1968, 1981 - 1982	ADF&G
	Sonar	Noatak River Sonar	1981 - 83, 1991 - 94	ADF&G
	Test Fishing	Kobuk River Test Fishing	1993 - Present	ADF&G
	Test Fishing	Noatak River Test Fishing	1975 - 1984, 1987 - Present	ADF&G
Kuskokwim	Aerial Survey	Kuskokwim Aerial Surveys	1976 - Present	ADF&G
	Age-Sex-Length Sampling	Kuskokwim Commercial Age-Sex-Length Sampling	1961 - Present	ADF&G
	Biological Study	Kuskokwim River Energetics of Juvenile Chum Salmon	2004	USGS
	Catch and Effort Assessment	Kuskokwim Commercial Catch and Effort Assessment	1960 - Present	ADF&G
	Catch and Effort Assessment	Kuskokwim Sport Fish Catch and Effort Assessment	Present	ADF&G
	Catch and Effort Assessment	Kuskokwim Subsistence Catch and Effort Assessment	1960 - Present	ADF&G
	Counting Tower	Kanektok River Tower	1960 - 1962, 1996 - 1999	NVK, USFW, ADF&G, AVCP, BSFA, BIA
	Counting Tower	Kogruklu River Tower	1969 - 1970, 1972 - 1978	ADF&G
	Counting Tower	Kwethluk River Tower	1996 - 1999	AVCP
	Counting Tower	Middle Fork Goodnews River Tower	1981 - 1990	ADF&G
	Counting Tower	Takotna River Tower	1995 - 1999	TCS
	Genetic Study	Kuskokwim Coho Salmon Genetic Variation	2002 - 2004	USFWS
	Genetic Study	Kuskokwim Coho Salmon Genetic Variation	2004 - 2006	USFWS
	Mark/Recapture	Area M Mark/Recapture	1960, 1987	ADF&G
	Mark/Recapture	Hooper Bay Mark/Recapture	1985	BSFA
	Mark/Recapture	Kuskokwim River Set Gillnet	1966	ADF&G
	Radio Telemetry	Holitna River Radiotelemetry	2001 - 2004	ADF&G
	Radio Telemetry	Kuskokwim River Chinook Salmon Radiotelemetry	2002 - Present	ADF&G
	Radio Telemetry	Kuskokwim River Chum Salmon Radiotelemetry	1995	BSFA
	Radio Telemetry	Kuskokwim River Sockeye Salmon Radiotelemetry	2005 - Present	ADF&G
	Sonar	Aniak River Sonar	1980 - Present	ADF&G
	Sonar	Kanektok River Sonar	1982 - 1987	ADF&G
	Sonar	Kuskokwim River Sonar	1993 - 1995	ADF&G

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Table 7.–Page 2 of 7.

Area	Project Type	Project Name	Years of Operation	Agency
Kuskokwim	Sonar	Kwethluk River Sonar	1978 - 1979	ADF&G
	Survey	Kuskokwim Bay Juvenile Salmon Survey	2004	USGS
	Survey	Kuskokwim River Fall Chum Surveys	2004	ADF&G
	Tagging	Kuskokwim River Salmon Tagging Project	2001 - Present	ADF&G
	Test Fishing	Aniak Test Fishing	1992 - 1995	ADF&G
	Test Fishing	Bethel Drift Gillnet Test Fishing	1983 - Present	ADF&G
	Test Fishing	Chuathbaluk Test Fishing	1992 - 1993	ADF&G
	Test Fishing	Eek Test Fishing	1988 - 1990, 1992 - 95	ADF&G
	Test Fishing	Kuskokwim River Subsistence Test Fishing	1988 - 1990	ADF&G
	Test Fishing	Kwegooyuk Set Gillnet Test Fishing	1966 - 1983	ADF&G
	Test Fishing	Lower Kuskokwim River Test Fishing	1995	AVCP
	Test Fishing	Quinhagak Drift Gillnet	1969 - 1970	ADF&G
	Test Fishing	Tuluksak Fish Wheel Test Fishing	1961 - 1962	ADF&G
	Weir	George River Weir	1996 - Present	KNA, ADF&G
	Weir	Kanektok River Weir	1999 - Present	NVK,ADF&G
	Weir	Kogruklu River Weir	1976 - Present	ADF&G
	Weir	Kwethluk River Weir	1979, 1992, 2000-Present	USFW
	Weir	Middle Fork Goodnews River Weir	1991 - Present	ADF&G
	Weir	Salmon River Weir	1981 - 1982	ADF&G
	Weir	Takotna River Weir	2000 - Present	TCS
Weir	Tatlawiksuk River Weir	1998 - Present	KNA, ADF&G	
Weir	Tuluksak River Weir	1991 - 1994, 2001 - Present	USFW	
Norton Sound	Aerial Survey	Norton Sound Aerial Surveys	1959 - Present	ADF&G
	Age-Sex-Length Sampling	Boston Creek Chum Salmon Carcass Sample	1978	ADF&G
	Age-Sex-Length Sampling	Golovin Bay District Commerical Sampling	1963, 1985 - 86	ADF&G
	Age-Sex-Length Sampling	Moses Point District Commerical Sampling	1962 - 63, 1967 - 69, 1975, 1977- 78, 1982 - 83, 1985 -	ADF&G
	Age-Sex-Length Sampling	Nome District Commercial Sampling	1978, 1980	ADF&G
	Age-Sex-Length Sampling	Shaktoolik District Commerical Sampling	1986, 1989 - 91, 1994, 1996, 1998, 2001 - Present	ADF&G
	Age-Sex-Length Sampling	Sinuk River Chum Salmon Carcass Sample	1978	ADF&G
	Age-Sex-Length Sampling	Unalakleet District Commerical Sampling	1962 - 63, 1967 - Present	ADF&G
Catch and Effort Assessment	Commercial Catch and Effort Assessment	1961 - Present	ADF&G	

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Table 7.--Page 3 of 7.

Area	Project Type	Project Name	Years of Operation	Agency
Norton	Catch and Effort Assessment	Sport Fish Catch and Effort Assessment	Present	ADF&G
Sound	Catch and Effort Assessment	Subsistence Catch and Effort Assessment	1963 - 82, 1994 - Present	ADF&G
	Counting Tower	Chirosky River Tower	1975 - 1976	ADF&G
	Counting Tower	Eldorado River Tower	1995 - 2001	KC, ADF&G
	Counting Tower	Kachauvik River Tower	1977 - 1978	ADF&G
	Counting Tower	Kwiniuk River Tower	1965 - Present	ADF&G
	Counting Tower	Niukluk River Tower	1979, 1995 - Present	ADF&G
	Counting Tower	Nome River Tower	1993 - 1995	ADF&G
	Counting Tower	North River Tower	1972 - 74, 1984 - 86, 1996 - Present	UIRA
	Counting Tower	Nunakogak River Tower	1992	ADF&G
	Counting Tower	Pikmiktalik River Tower	1992, 2003 - Present	KC, ADF&G
	Counting Tower	Pilgrim River Tower	1997 - 98, 2000, 2002	KC, ADF&G
	Counting Tower	Shaktoolik River Tower	1996 - 1998	BLM, ADF&G
	Counting Tower	Snake River Tower	1995 - 2001	KC, ADF&G
	Counting Tower	Tubutulik River Tower	1980	ADF&G
	Genetic Study	Genetic Studies	Present	ADF&G
	Incubation Box	Anvil Creek Ponds Incubation Boxes	1998 - 2000	ADF&G
	Incubation Box	Boulder Creek Incubation Box	1991 - 98	ADF&G
	Incubation Box	Coral Creek Incubation Box	1991 - 98, 2000	ADF&G
	Incubation Box	Hobson Creek Incubation Box	1998 - 99	ADF&G
	Incubation Box	Kwiniuk River Incubation Box	1998	ADF&G
	Incubation Box	Salmon Lake Incubation Box	1997 - 2000	ADF&G
	Incubation Box	Shovel Creek Incubation Box (Solomon River)	1995 - 98	ADF&G
	Incubation Box	Sinuk River Incubation Box	1998	ADF&G
	Mark/Recapture	Area M Mark/Recapture	1960, 1987	ADF&G
	Mark/Recapture	Hooper Bay Mark/Recapture	1985	BSFA
	Mark/Recapture	Nome District Chum Salmon Mark/Recapture	1978 - 79	ADF&G
	Mark/Recapture	Norton Sound Stock Separation Studies	1978 - 79	ADF&G
Mark/Recapture	Unalakleet River Tagging	1972 - 75	ADF&G	
Other	Salmon Lake Fertilization	1997 - Present	ADF&G	
Radio Telemetry	Fish River Radiotelemetry	2002 - Present	ADF&G	

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Table 7.–Page 4 of 7.

Area	Project Type	Project Name	Years of Operation	Agency
Norton Sound	Radio Telemetry	Unalakleet River Radio Telemetry Mark/Recapture	1997 - 1998, 2004 - Present	ADF&G
	Scale Pattern Analysis	Scale Pattern Analysis	1978	ADF&G
	Smolt Trap	Pilgrim River Smolt Trap (Salmon Lake)	1995-96, 1998-2000,02-Present	ADF&G
	Sonar	Unalakleet River Sonar	1983 - 1985	ADF&G
	Test Fishing	Unalakleet River Test Fishing	1981 - Present	ADF&G
	Weir	Eldorado River Weir	2002 - Present	KC, ADF&G
	Weir	Glacial Lake Weir	1979, 2000 - Present	BLM
	Weir	Nome River Weir	1996 - Present	ADF&G
	Weir	Pilgrim River Weir	1999 - Present	KC, ADF&G
	Weir	Snake River Weir	2002 - Present	KC, ADF&G
Yukon	Aerial Survey	Delta Clearwater Aerial Sruveys	1972 - Present	ADF&G
	Aerial Survey	Nenana Aerial Surveys	1974 - Present (Intermittent)	ADF&G
	Aerial Survey	Yukon River Aerial Surveys	1960 - Present	ADF&G, DFO
	Age-Sex-Length Sampling	Yukon Age Sex Length Sampling	1961 - Present	ADF&G
	Biological Study	Ichthyophonus hoferi Study	1999 - Present	BSFA, UW
	Biological Study	Yukon River Chum Salmon Ecology	1996 - Present	USGS,BRD
	Catch and Effort Assessment	Hooper Bay Study	2000 - Present	HBTC
	Catch and Effort Assessment	Lower Yukon Sportfish Catch and Effort Assessment	Present	ADF&G
	Catch and Effort Assessment	Subsistence & Personal Use Permits	Present	ADF&G
	Catch and Effort Assessment	Tanana River Sportfish Catch and Effort Assessment	Present	ADF&G
	Catch and Effort Assessment	Upper Yukon Sportfish Catch and Effort Assessment	Present	ADF&G
	Catch and Effort Assessment	Yukon Catch and Effort Assessment	1960 - Present	ADF&G
	Catch and Effort Assessment	Yukon Subsistence Surveys	1960 - Present	ADF&G
	Counting Tower	Andreafsky River Tower	1986 - 1988	ADF&G
	Counting Tower	Anvik River Tower	1972 - 78	ADF&G
	Counting Tower	Chatanika River Tower	1998 - Present	ADF&G
	Counting Tower	Chena River Tower	1993 - Present	ADF&G
	Counting Tower	Clear Creek Tower	1995 - 1999	TCC
	Counting Tower	Kaltag River Tower	1991 - Present	UAF
	Counting Tower	Nulato River Tower	1994 - Present	NTC, ADF&G
Counting Tower	Salcha River Tower	1993 - Present	ADF&G	
Counting Tower	Tozitna River Tower	2001 - Present	BLM	
Counting Tower	Whitehorse Dam Fishway Tower	1959 - Present	DFO	

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Table 7.--Page 5 of 7.

Area	Project Type	Project Name	Years of Operation	Agency
Yukon	Mark/Recapture	Area M Mark/Recapture	1960, 1987	ADF&G
	Mark/Recapture	Galena/Ruby Mark/Recapture	1976 - 1980	ADF&G
	Mark/Recapture	Hooper Bay Mark/Recapture	1985	BSFA
	Mark/Recapture	Kantishna Mark/Recapture Recovery Wheel	1976 - 1980	USFWS, ADF&G
	Mark/Recapture	Rampart Rapids Mark/Recapture	1996 - Present	USFWS
	Mark/Recapture	Rampart Tagging Project	1972 - 1973	ADF&G
	Mark/Recapture	Toklat River Mark/Recapture	1996 - Present	ADF&G
	Mark/Recapture	Upper Tanana River Mark/Recapture	1995 - Present	ADF&G
	Mark/Recapture	Upper Yukon Salmon Tagging Program (Yukon Territory)	1982-Present	DFO
	Mark/Recapture	Yukon & Tanana Rivers Fall Chum Tagging	1976 - 1980	ADF&G
	Mark/Recapture	Yukon River Mark/Recapture	1961 - 1971	ADF&G
	Other	Clear Hatchery Producing Toklat Stocks CWT	1992 - 1995	ADF&G
	Other	Toklat River Fall Chum Restoration Feasibility	1992 - 1999	ADF&G
	Radio Telemetry	Canadian Mainsteam Yukon River Mark/Recapture	1982 - 1983, 1985 - Present	DFO
	Radio Telemetry	Porcupine River Chum Radio Telemetry	1998	NMFS
	Radio Telemetry	Tanana River Chum Salmon Radio Telemetry	1989	ADF&G
	Radio Telemetry	Toklat River Radio Telemetry	1997	ADF&G
	Radio Telemetry	Upper Tanana River Radio Telemetry	1992	ADF&G
	Radio Telemetry	Upper Yukon Chum Salmon Radio Tagging	1982 - 1983	NMFS
	Radio Telemetry	Yukon River Chinook Salmon Radio Telemetry	2000 - Present	ADF&G
	Radio Telemetry	Yukon River Fall Chum Radio Telemetry Feasibility Study	1998 - 1999	NOAA, USFWS
	Scale Pattern Analysis	Yukon Chinook Scale Pattern Analysis	1980 - Present	ADF&G
	Scale Pattern Analysis	Yukon Chum Scale Pattern Analysis	1974 - 1977, 1982, 1986	ADF&G
	Sonar	Andreafsky River Sonar	1981 - 1985	ADF&G
	Sonar	Anvik River Sonar	1979 - Present	ADF&G
	Sonar	Chandalar River Sonar	1986 - 1990, 1995 - Present	USFW
	Sonar	Koyukuk River Sonar (South Fork)	1990	USFW
	Sonar	Melozitna River Sonar	1981 - 1983	ADF&G
	Sonar	Pilot Station Sonar	1986 - Present	ADF&G
	Sonar	Sheenjek River Sonar	1981 - Present	ADF&G
	Sonar	Tanana River Sonar	1981	ADF&G
	Sonar	Toklat River Sonar	1994 - 1996	ADF&G
	Sonar	Yukon Border Sonar, Eagle	1992 - 1994	ADF&G
Survey	Bluff Cabin Slough Escapement Surveys	1980 - Present	ADF&G	

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Table 7.–Page 6 of 7.

Area	Project Type	Project Name	Years of Operation	Agency
Yukon	Survey	Delta Clearwater Boat Surveys	1972 - Present	ADF&G
	Survey	Delta River Escapement Surveys	1971 - Present	ADF&G
	Survey	Nenana Ground Surveys	1974 - Present (Intermittent)	ADF&G
	Test Fishing	Big Eddy Drift Gillnet Test Fishing	1987 - 1989, 1999 - Present	ADF&G
	Test Fishing	Big Eddy Set Gillnet Test Fishing	1979 - Present	ADF&G
	Test Fishing	Fish Village Drift Gillnet Test Fishing	1982 - 1983	ADF&G
	Test Fishing	Flat Island Set Gillnet Test Fishing	1963 - 1978	ADF&G
	Test Fishing	Fort Yukon Fish Wheels	1995 - 1996	CATG, ADF&G
	Test Fishing	Galena Fish Wheel	1995	ADF&G
	Test Fishing	Kaltag Drift Gillnet Test Fishing	1999 - Present	CK
	Test Fishing	Kaltag Fish Wheel (Stink Creek)	1980 - 1983	ADF&G
	Test Fishing	Manley Fish Wheel	1984 - 1985, 1988 - 1993	ADF&G
	Test Fishing	Marshall Drift Gillnet Test Fishing	1999 - Present	ADF&G
	Test Fishing	Middle Mouth Drift Gillnet Test Fishing	2001 - Present	ADF&G
	Test Fishing	Middle Mouth Set Gillnet Test Fishing	1979 - Present	ADF&G
	Test Fishing	Mountain Village Drift Gillnet Test Fishing	1995 - Present	ATC
	Test Fishing	Nenana Fish Wheel	1988 - Present	ADF&G
	Test Fishing	Ruby Fish Wheel	1980 - 1991	ADF&G
	Test Fishing	Tanana River Fish Wheel	1992 - Present	
	Weir	Andreafsky River Weir, East Fork	1994 - Present	USFW
	Weir	Barton Creek Weir	1994 - 1996	ADF&G
	Weir	Beaver Creek Weir	1996 - 2000	BLM
	Weir	Blind Creek Weir	1997 - 2000	RRDC
	Weir	Chandindu River Weir	1999 - Present	YCFA, THFN
	Weir	Clear Creek Weir	2000-Present	BLM
	Weir	Fishing Branch River Weir	1972 - 1975, 1985 - 1989, 1990 - Present	DFO
	Weir	Gisasa River Weir	1994 - Present	USFW
	Weir	Henshaw Creek Weir	1999 - Present	USFW/TCC
	Weir	Koyukuk River Weir (South Fork)	1996 - 1998	USFW
	Weir	Tatchun Creek Weir	1997 - 2000	DFO
	Weir	Tozitna River Weir	2002 - Present	BLM

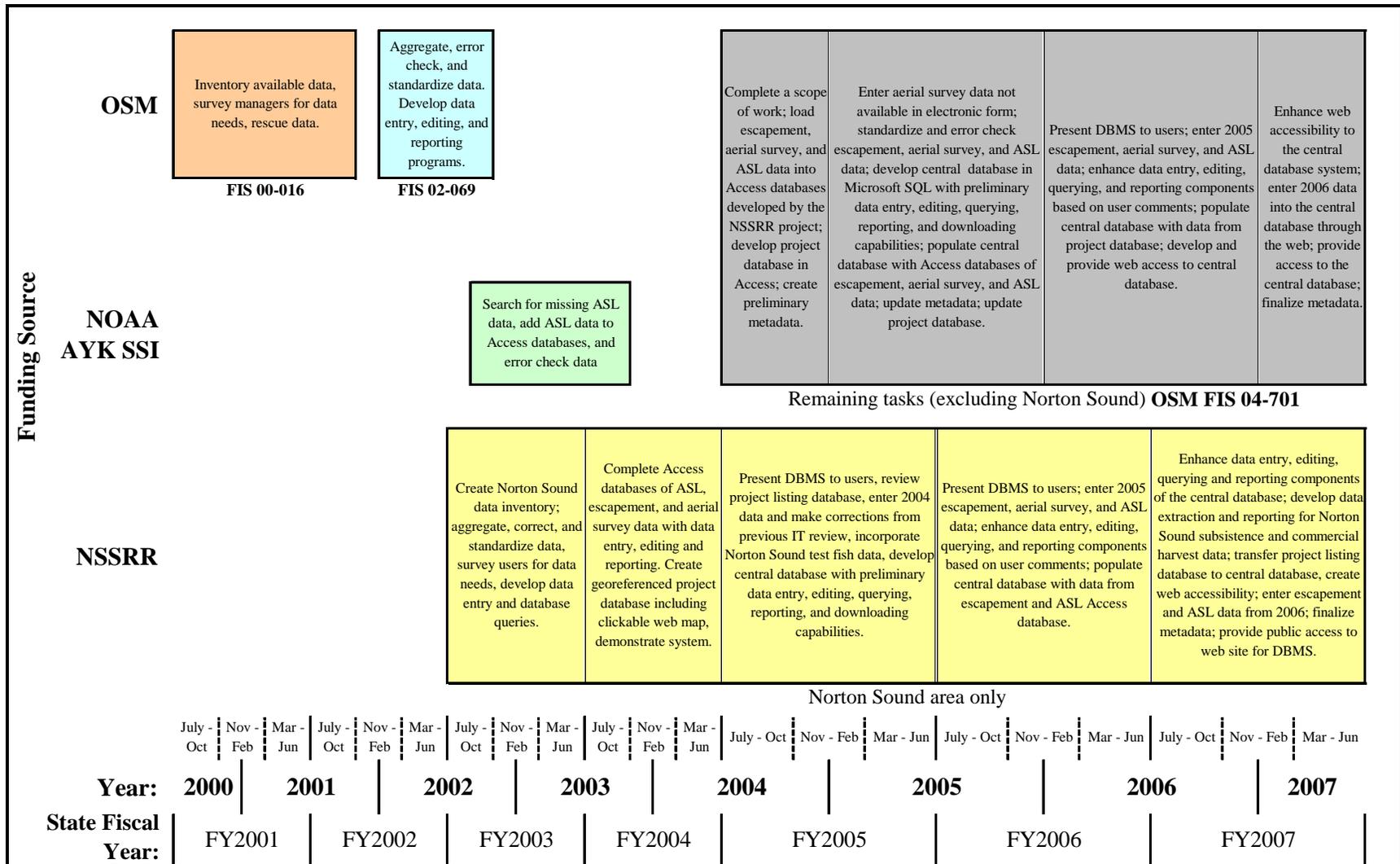
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Acronym	Agency Name	Acronym	Agency Name
ADF&G	Alaska Department of Fish and Game	NTC	Nulato Tribal Council
AVCP	Association of Village Council Presidents	NVK	Native Village of Kwinhagak
BIA	Bureau of Indian Affairs	RRDC	Ross River Dena Council
BLM	Bureau of Land Management	TCC	Tanana Chiefs Conference
BSFA	Bering Sea Fisherman's Association	TCS	Takotna Charter School
CATG	Council of Athabaskin Tribal Governments	THFN	Trondek Hwechin First Nation
CK	City of Kaltag	UAF	University of Alaska Fairbanks
DFO	Canada Department of Fisheries and Oceans	UIRA	Unalakleet IRA
HBTC	Hooper Bay Tribal Council	USFWS	U. S. Fish and Wildlife Service
KC	Kawerak, Inc.	USGS	U. S. Geological Service
KNA	Kuskokwim Native Association	UW	University of Washington
NOAA	National Oceanic Atmospheric Association	YRCFA	Yukon River Commercial Fisheries Association

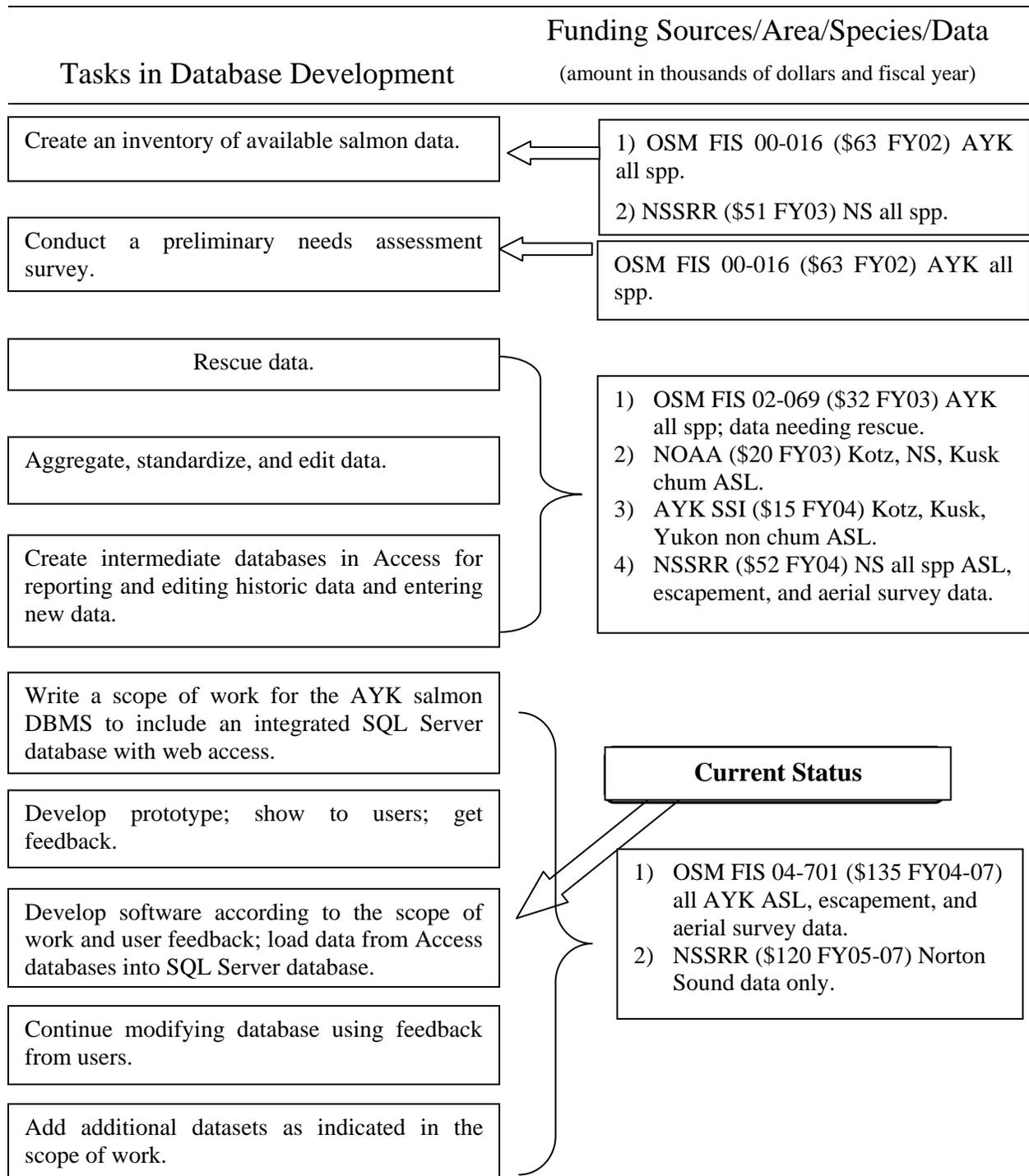


Figure 1.—AYK Region Salmon Management Areas.



Note: 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.

Figure 2.—Project timeline for development of the AYK salmon database management system.



Note: 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. Not included is state general fund support of an Analyst/programmer IV, Analyst/programmer III, and a Research Analyst I (\$150,000 annually).

Figure 3.—Tasks for development of the AYK salmon database management system (salmon DBMS) including funding sources, amounts by fiscal year, and area.

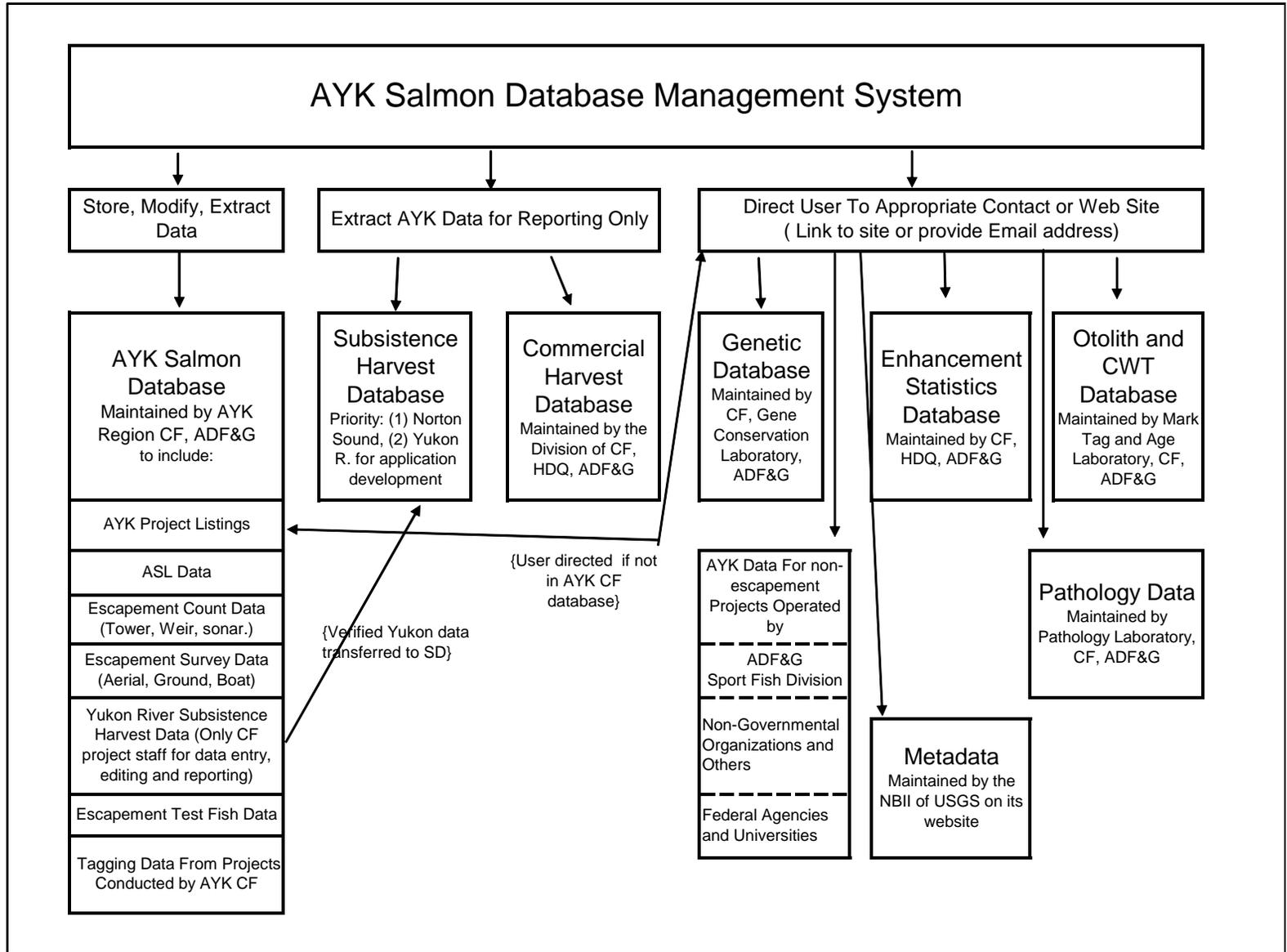


Figure 4.—Components of the AYK salmon database management system.

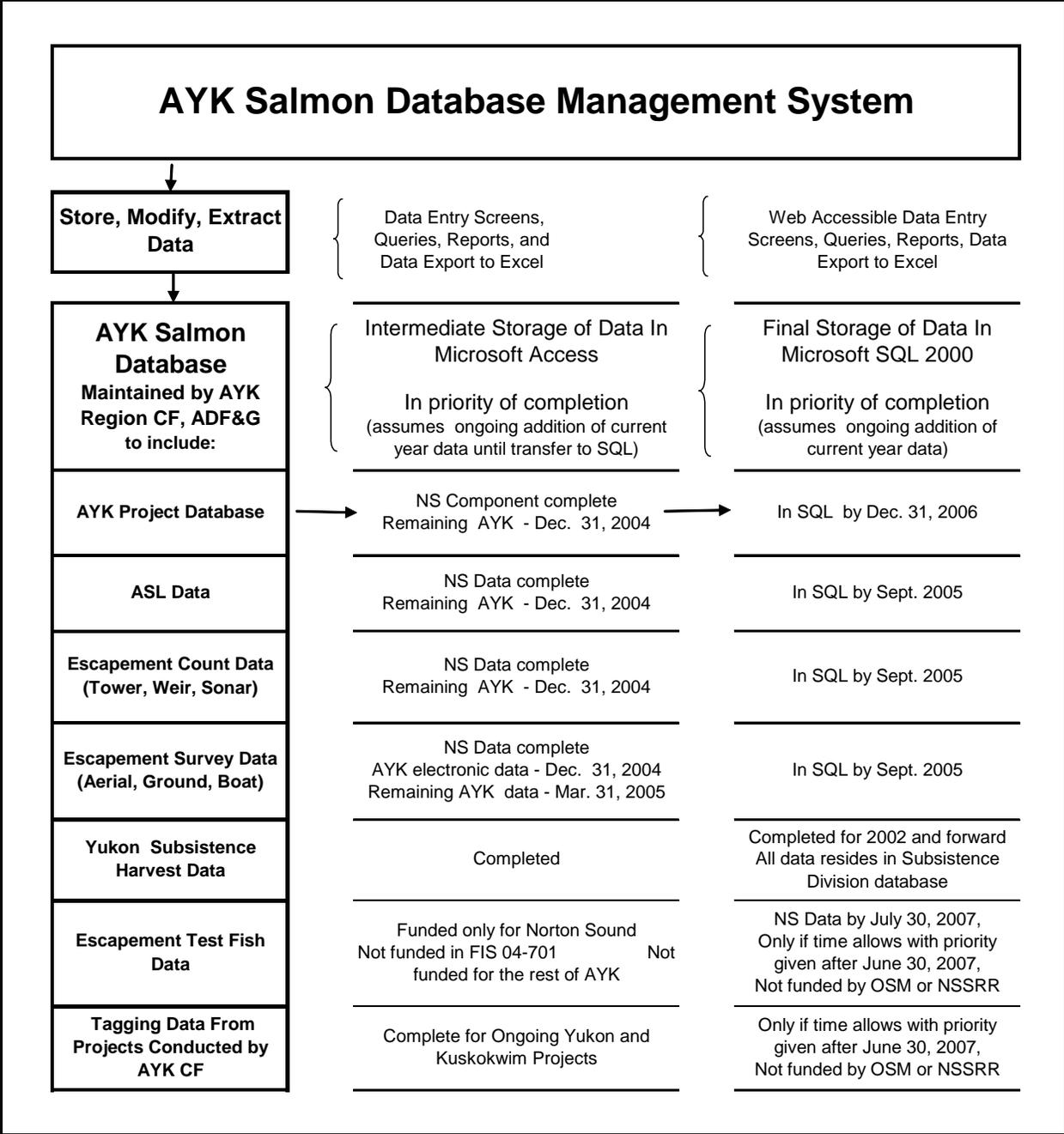


Figure 5.—Priority and timeline for database components maintained by the Division of Commercial Fisheries AYK Region, September 2004.

APPENDIX A.

Appendix A1.—Escapement survey data by area and stream in the AYK salmon database management system.

Area	Stream	Year Range ^a	Number of Surveys With Counts of						No. Fish
			Chinook	Chum	Coho	Pink	Sockeye	Unknown Salmon	
Kotzebue	Agashashok River	1963–1999		4					1
	Ambler River	1962						1	
	Asikpak River	1982	1						1
	Avan River	1981	1						1
	Buckland River	1996–1998			2				
	Cutler River	1966–1980			1				2
	Eli River	1962–2003	1	23		4		2	
	Fish Creek	1982–1984			1		3	2	
	Goodhope River	1996							1
	Hunt River	1962–1963						1	1
	Ikalukrok Creek	1968–1986	1	3		1	1		1
	Inmachuk River	1973–2002			10		7	2	1
	Kaligurick River	1963–1973			1				1
	Kallarichuk River	1967–1988			5		1		
	Kauk River	1996			1				
	Kelly River And Lake	1962–2003	6	33		1	1	3	
	Kitlik River	1979			1				
	Kivalina River	1968–1997	2	4				1	4
	Kiwaluk River	1963–1997	2	1	2	1			2
	Kobuk River	1962–2003	6	36					14
	Kugruk River	1974–1996	2						3
	Kugururok River	1974–1984	1	3					1
	Kukpuk River	1960					1		
	Maunelluk River	1960							1
	Mint River	1996			1				
	Nimiuktuk River	1965–1984	1	3					1
	Noatak River	1960–2003	3	36		5		5	3
	Omar River	1976			1				
	Pah River	1979			1				
	Pinguk River	1996			1				
	Redstone River	1963							1
	Salmon River	1962–1999			33		1		2
	Selawik River	1968							1
	Selby River	1962–2003	1	13					1
	Serpentine River	1996							1
	Shungnak River	1962–1968			2				1
Singoalik River	1960					1			
Squirrel River	1962–1999	9	34	1	7		1	7	
Tutak Creek	1984		1						
Tutuksuk River	1962–1999	1	29			1		2	
Unknown	1979			1					
Wrench Creek	1981–1984	1	1					1	
Wulik River	1960–1997	4	6	1	3			8	
Kuskokwim	3 Lakes below Kagati Lake	1961–1974					10		
	Aniak Lake	1960–1978							5
	Aniak River	1954–2004	41	33	10	9	16	11	10
	Aniak Sonar	1980	1	1	1				
	Arolik Lake	1960–1987	2	1	1	1	3	1	2

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Appendix A1.—Page 2 of 11.

Area	Stream	Year Range ^a	Number of Surveys With Counts of						Unknown Salmon	No. Fish
			Chinook	Chum	Coho	Pink	Sockeye			
Kuskokwim	Arolik River	1959–1997	9	8	5	3	8	2	2	
	Arolik River, South Fork	1984	1	1	1	1	1	1		
	Awayak Lake North	1967–1976					3			
	Awayak Lake South	1967					1			
	Babel River	2001	1	1						
	Barnum Creek	1968–1987	1	1	2	1	1	1		
	Bear Creek	1977–1987	4	3	3	3	3	3	1	
	Bear Creek (Pitka Fork)	1975–2004	9	2	2	1	1		1	
	Bessie Creek	1984	1	1	1	1	1	1		
	Big Creek (Lower)	2000–2003	1	1	4	1	1		3	
	Big River	1971–2003	1	3	3					
	Big Salmon Fork	1975–2000	2	1				1	2	
	Big Waldron	2000–2003	1	1	2	1	1		4	
	Bimahyook Creek	1993	1	1	1	1	1			
	Blackwater Creek	1975–1978	2						2	
	Bonnie Creek	2000–2002	1	1	1	1	1		2	
	Broken Snowshoe Creek	2000	1	1	1	1	1		1	
	Buckstock River	1960–1976	2	2					1	
	Can Creek	1966–2001	9	10					2	
	Canyon Creek	1987	1	1	1	1	1	1		
	Canyon Creek (Crooked Creek)	1972–1994	12	8	6	5	5	7		
	Canyon Lake	1961–1987	1	1	2	1	4	1		
	Carter Creek	1968–1987	1	1	1	1	1	1	2	
	Cheeneetnu River	1968–2004	22	16	6	5	5	7	3	
	Chineekluk Creek	1968–1988	9	5	3	3	4	3		
	Chineekluk Lake	1980							1	
	Chuilnu Lake	1966							1	
	Chukowan River	1961–1988	14	12	3	3	7	2	2	
	Cottonwood Creek	2000	1	1	1	1	1			
	Cottonwood Creek (W.B. Cr)	2000			1				1	
	Cripple Creek	1968–1987	1	1	1	1	1	1	1	
	Crooked Creek	1975–1976	1	2						
	Dadinowiki Creek	1993	1	1	1	1	1			
	Daprakmiut River	1993	1	1	1	1	1			
	Deep Creek	2000							1	
	Dennis Creek	1976	1							
	Dillinger River	1975							1	
	Donlin Creek	1975							1	
	Eagle Mountain Creek	1968							1	
	East Fk Oskawalik R	1959							1	
	Eek River	1960–2004	16	12	10	7	10	6	3	
	Eek River, Middle Fork	1975–1990	5	5	2	2	3	2		
	Fish Creek	2000–2001							2	
	Fish River	2003			1					
	Fog River	1983–1987	2	2	1	1	1	1		
	Fourth of July Creek	2000–2004	4	4	4	2	2		1	
Gagaryak River	1968–2004	16	8	2	1	1	3	1		
Gemuk Lake	1966–1980							2		

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Appendix A1.–Page 3 of 11.

Area	Stream	Year Range ^a	Number of Surveys With Counts of						Unknown Salmon	No. Fish
			Chinook	Chum	Coho	Pink	Sockeye			
Kuskokwim	Gemuk River	1961–1974	4	1						
	George River	1960–2004	8	6	1	1	1		2	
	George River, East Fork	1976–2002	3	3					1	
	George River, North Fork	1975–2001	1	3						
	George River, South Fork	2001	1	1						
	Gold Lake	1979							1	
	Goodnews Lake	1957–1992	5	5	5	7	21	6		
	Goodnews Middle Fork Lakes	1966–1992	9	7	8	7	16	8		
	Goodnews Middle Fork River	1959–2004	21	16	12	11	20	8	2	
	Goodnews River	1959–2004	28	22	14	17	25	12	1	
	Granite Creek	1983–1985	1	1	2	1	1	1		
	Highpower Creek	1971–2003	1	1	2				2	
	Hoholitna River	1968–2001	4	6	1		1		1	
	Holitna River	1961–2004	27	23	6	6	17	5	4	
	Holitna Weir	1976–1980	4	4		3	4		1	
	Holokuk Lake (Tevyaraq?)	1966–2000	7	7	4	3	3	2	3	
	Holokuk River	1960–2004	21	19	5	4	7	5	3	
	Hook Creek	2001	1	1						
	Indian Creek (Indian River)	1968–1987	2	1	1	1	1	1	1	
	Ivy Creek	2000							1	
	Jacksmith Creek	1968–1989	2	2	2	2	2	2	1	
	Jewoak Creek	1993	1	1	1	1	1			
	John Reek Creek	2000–2001							2	
	Jones Creek	2000–2001	1						1	
	Jones River	1975–2003	2	1	3				1	
	K8-2	1960		1						
	Kagati Lake	1959–1976			1		12		1	
	Kahniruk River	1993	1	1	1	1	1			
	Kalmakof River	1960–2001	1	1					1	
	Kanektok River	1960–2004	38	33	18	18	36	12	6	
	Kanektok Tower (low)	1960	1	1		1	1			
	Kanektok Tower (up)	1961–1962					2			
	Kanuktik Creek	1959–1990	5	2	2	2	4	2	1	
	Kanuktik Lake	1959–1987	1	1	1	1	1	1	5	
	Kasigluk River	1974–1997	9	10	3	3	3	4	4	
	Kasigluk Sonar	1979	1	1						
	Kinegnak River	1975–1997	5	5	1	3	5	1		
	Kipchuk River	1959–2004	28	23	8	5	7	8	1	
	Kisaralik Lake	1960–1977			1				4	
	Kisaralik River	1959–2004	29	26	12	6	7	7	1	
Kogruklu River	1961–2004	17	11	2	2	9	2	1		
Kogruklu Tower	1969–1978	9	9	1	2	9				
Kogruklu Weir	1971	1	1			1				
Kristin Creek	1985	1	1	1	1	1	1			
Kukaktlim Lakes	1959–1976					7		1		
Kuskokwim River	1976		1							
Kuskokwim River, East Fork	1971	1	1							
Kuskokwim River, North Fork	1971		1	1						

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Appendix A1.–Page 4 of 11.

Area	Stream	Year Range ^a	Number of Surveys With Counts of						Unknown Salmon	No. Fish
			Chinook	Chum	Coho	Pink	Sockeye			
Kuskokwim	Kwethluk River	1960–2004	24	19	8	5	5	6	6	
	Kwethluk Sonar	1978							1	
	Lake above Kanuktik Lake	1971							1	
	Lincoln Creek	2000			1				1	
	Little Kasigluk River	1977	1							
	Little Swift Creek	1985	1	1	1	1	1	1		
	Little Tonzona River	1979–2004	2	2	2	2	2		3	
	Little Underhill Creek	1966	1							
	Little Waldron	2000–2003	2	2	3	2	2		3	
	Lonestar Creek	2000							1	
	Minnie Creek	2000–2002	1	1	1	1	1		1	
	Moore Cr.	2000–2003	1	1	3	1	1		2	
	Nash Harbor Creek	1993	1	1	1	1	1			
	Nixon Fork	1987–2001	3	2	4	2	2	2	1	
	Nukluk Creek	1961	1							
	Ophir Creek	1966–1968							2	
	Oskawalik River	1960–2004	23	21	6	5	5	5	3	
	Owhat River	1960							1	
	Oyak Creek	1988	1	1	1	1	1	1		
	Pitka Fork	1975–1977	2	2				1	1	
	Pitka Fork (U/S Fr Salmon)	2000	1	1	1	1	1			
	Post River	1975							1	
	Pothole Lakes	1976					1			
	Quicksilver Creek	1977							1	
	Quicksilver Lakes	1966							1	
	Salmon River	1959–2004	37	29	13	9	14	12	2	
	Salmon River Pitka Fork	2000–2004	5	2	2	1	1		1	
	Selatna River	1968–2001	4	2						
	Sheep Creek Pitka Fork	2000–2002	2	1	2	1	1		1	
	Shotgun Creek	1966–2004	5	3						
	Slate Creek	1983–1987	4	3	3	3	3	3		
	Slow Fork	2000	1	1	1	1	1		1	
	Soda Creek	1976	1							
	South Fork Goodnews River	1976–1987	5	5	2	4	5	2		
	South Fork Hoholitna River	1975–2001	2	2	1	1	1			
	South Fork Kuskokwim River	1971–2003	2	4	4	1	1		1	
	South Fork, Unnamed Trib 1	2001	1							
	South Fork, Unnamed Trib 2	2001		1	1					
	South Fork, Unnamed Trib 3	2001		1	1					
	South Lake	1959					1			
	Stink River	1966–2000							2	
	Stony River	1959							1	
Sullivan Creek	1976–2002	3	1	2	1	1				
Swift River	1959–1968							3		
Swift River, North Fork	2001	1	1							
Takikichak River	1991			1						
Takotna River	1976–2002	6	6	6	4	4	2	2		
Takshilik Creek	1968			1						
Tatina River	1975							1		

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Area	Stream	Year Range ^a	Number of Surveys With Counts of						Unknown Salmon	No. Fish
			Chinook	Chum	Coho	Pink	Sockeye			
Kuskokwim	Tatlawiksuk River	1968–2004	13	12	3	2	2	3	4	
	Telaquana Lake	1960–2001	4	2	2	2	6	2	1	
	Telaquana River	1966–2000	1	1	1	1	1		1	
	Telidaside Creek	2000							1	
	Tevyaraq Lake	1977–1993	4	4	4	4	9	4		
	Titnuk Creek	1966							1	
	Trout Lake	1966						1		
	Tuluksak River	1965–2004	22	20	11	8	8	8	2	
	Tunkaleshna Creek	1968							1	
	Tunulik River	1968		1						
	Two Lakes	1966–2001	2	2	1	1	3	1	1	
	Unaluk River	1968–1997	1	1	1		1		1	
	Unnamed Creek (parallels SF)	2000	1	1	1	1	1			
	Unnamed Trib of Big River	2001	1							
	Unnamed Trib of Big River 2	2001	1							
	Unnamed Trib of Big River 3	2002	1	1	1	1	1			
	Unnamed Trib of Big River 4	2001	1							
	Unnamed Trib of Middle Fork	2001	1						1	
	Unnamed Tributary	1966–1996	5	3	2	1	2	1	1	
	Unnamed Tributary of Big R.	2001							1	
	Unnamed Tributary of L.Tonzona	2000–2003	2	1	4	1	1		1	
	Unnamed Tributary of Windy R.	2001–2002	2	1	2	1	1			
	Upper Pitka Fork	2000–2004	5	2	1	1	1			
	Vreeland Creek	2001	1	1						
	Waterboot Creek	1972	1							
	West Fork	2000–2001	1	1	1				1	
	West Fork Oskawalik River	1959–1975	1	1					1	
	Whitefish Lake	1960–1968							3	
	Windy Fork	1996		1						
	Norton Sound	Belt Creek	1960–1990		2					1
		Bluestone River	1960–1991				1		1	
		Bonanza River	1963–2004	8	24	11	26	2		4
Boston Creek		1963–2004	31	32	4	24		1		
Canyon Creek		1966–1987		1		1			1	
Casadepaga River		1962–2003	2	6	3	4	1		2	
Chirosky River		1974–1981	3	4	1	3		1		
Cobblestone River		1961–1987		2		1		1	1	
Cripple River		1978–2004	2	10	9	15	1	1	2	
Eagle Creek		1966		1						
Egavik Creek		1960–1986	6	6		8		1	2	
Eldorado River		1962–2004	23	31	22	31	3	2	4	
Etchepuk River		1963–1979		2						
Feather River		1987		1						
Fish River		1961–2003	32	32	5	36		8	5	
Flambeau River		1963–2004	8	30	8	23			1	
Fox River	1973							1		
Glacial Lake	1969–2004	1				25		1		
Golsiva River	1959–2002	2	3	2	4					

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Area	Stream	Year Range ^a	Number of Surveys With Counts of						
			Chinook	Chum	Coho	Pink	Sockeye	Unknown Salmon	No. Fish
Norton Sound	Inglutalik River	1961–2004	12	11		10		6	
	Kachauvik River	1963–1982	1	12		12		2	1
	King Metolik	1983	1	1					
	Kogok River	1981–1995	6	6	5	4		1	1
	Kougarok River	1960							1
	Koyuk River	1961–1979	1	1		1		1	1
	Koyuk River, East Fork	1979	1						
	Kuzitrin River	1960–1966						4	
	Kwik River	1963–1966							2
	Kwiniuk River	1962–2004	18	32	16	23		12	3
	Nigikmagoon River	1976				1			
	Niukluk River	1962–2004	24	37	20	29	1	5	2
	Nome River	1960–2004	23	34	22	34	8	8	4
	North River	1962–2004	32	25	16	24		9	3
	Noxapaga River	1963						1	
	Nunavulnak River	1982			1	1	1		
	Old Woman River	1962–2004	17	18	13	11		2	1
	Ophir Creek	1984–2002	1		16				
	Paragon River	1963–1982	2	8		5			
	Peace River	1966		1					
	Penny River	1975–2004	1	11	9	14		2	4
	Pikmiktalik River	1981–2003	2	4	1	4			1
	Shaktoolik River	1961–2004	30	27	10	23	1	7	1
	Sinuk River	1961–2004	13	29	22	30	15	11	3
	Snake River	1966–2004	10	20	16	19	3	1	5
	Solomon River	1960–2004	7	27	15	27			5
	South River	1981				1			
	Tubutulik River	1962–2004	30	35	5	34		8	1
	Unalakleet River	1958–2004	26	26	12	20	2	9	4
	Unalakleet River, North Fork	1962–1982	5	4	3	3	1	2	
	Ungalik River	1960–2004	20	21	5	21		5	3
	Unknown T45 7W	1976		1		1			
Pt. Clarence	Agiapuk River	1961–1999	1	4		2		1	
	American River	1966–2003		4		1			
	Grand Central River	1963–2004		2	1	1	35	2	
	Pilgrim River	1963–2003	11	11	8	8	17	4	2
	Salmon Lake	1963–2004	2				38	2	1
Yukon	Alatna River	1959–1997	7	7				5	1
	Andersen Slough	1980–1989		5	1				
	Andreafsky River	1954–2004	47	38	2	14		24	1
	Andreafsky River, East Fork	2001–2004	4						
	Anvik River	1957–2004	42	31	5	9	3	22	4
	Baker Creek	1974	1	1				1	
	Banner Creek	1975	1	1				1	
	Barton Creek	1974–2000	10	5	7				1
	Batza Creek	1975	1	1				1	
	Bear Creek	1960–1990	4	5				5	2

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Appendix A1.–Page 7 of 11.

Area	Stream	Year Range ^a	Number of Surveys With Counts of						Unknown Salmon	No. Fish
			Chinook	Chum	Coho	Pink	Sockeye			
Yukon	Bearpaw River	1973–2004	13	17	7			3	6	
	Beaver Creek	1954–2004	9	3	1			4	2	
	Beaver Creek (Canada)	1975						1		
	Beaver River (Canada)	1973–1985	1					1	1	
	Benchmark No 735 Slough	1972–2003	8	16	3	1	1	9	1	
	Berry Creek	1976						1		
	Big Campbell Creek	1983							1	
	Big Creek	1980–2000	2	1	1	1	1	1	1	
	Big Kalzas River	1968–1985	3					2	1	
	Big Salmon River	1959–2003	36					14	2	
	Big Salt River	1974–2001	2	2				2		
	Billy Creek Slough	1980–1996	1	4				1		
	Birch Creek	1960–1997	2	4	1			4	5	
	Black River	1960–1994	1	3				4	1	
	Blackburn Creek	1976–1994	4	6		2		1		
	Blind Creek	1973–1987	3					1		
	Blue Creek	1974–2004	2	8	10	2	2	3		
	Bluff Cabin Creek	2001–2004		2	3					
	Bluff Cabin Island Slough	2004		1	1					
	Bluff Cabin Slough	1971–2004	10	32	19	1	1	10	1	
	Bonasila River	1957–2003	7	7				5	1	
	Canyon Creek	1985	1	1						
	Caribou Creek	1997	1	1						
	Central Creek	2001–2004	4	1						
	Chandalar River	1960–1993	8	13				8		
	Chandindu River	1977–1985	1					1	1	
	Charley River	1953–2002	6	3				5	2	
	Chatanika River	1954–2003	24	21	1	1	1	11	1	
	Chena River	1954–2003	38	33	1	2	1	16	5	
	Chief Creek	1976						1		
	Chisana River	1975–1977	2	2				3		
	Christian River	1960–1985	1	1				2	1	
	Christmas	1977–1985	1					1	2	
	Chuilnak River	1957–1992	10	10	1	2	1	5		
	Clear Creek	1974–2002	9	4	4	1	1	1		
	Clearwater Lake & Outlet	1962–2004	9	17	30	9	9	9		
	Clearwater Lake Outlet Slough	1972–2004	4	21	11			4		
	Coal Creek	1956						1		
	Coleen River	1960–1993	1	1				4	2	
	Coltus Creek	1985							1	
	Cosna River	1983–1985	1						1	
	Cottonwood Creek	1996							1	
	Crooked Creek	1956–1977	2					1	1	
	Dakli River	1960–1998	11	15				6	1	
	Dall River	1973–1985		1				1	1	
	Delta Clearwater River	1954–2004	13	28	36	12	11	13	1	
	Delta River	1962–2004	14	35	23	2	2	13	4	
	Dietrich River	1969–1986		1				2	1	

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Area	Stream	Year Range ^a	Number of Surveys With Counts of							No. Fish
			Chinook	Chum	Coho	Pink	Sockeye	Unknown Salmon		
Yukon	Dishna River	1974–1975	2	2				2		
	Donjek River	1961–1993	1	4				2	3	
	Dry Creek	1996							1	
	Dugan Creek	1976						1		
	Duke River	1976–1981	1	1				1	3	
	Dulbi River	1975							1	
	Eagle Creek	1956–1974						1	1	
	Earn River	1968–1985	5					2		
	Engineer Creek	1957	1	1				1		
	Fairwater Lake And Outlet	1968							1	
	Faith Creek	2003	1	1					1	
	Field Lake Outlet	1968						1		
	Fifteenmile River	1980						1		
	Fish Creek	1969–1997	3	2	1			3	3	
	Fishing Branch River	1971–1995	10	23	4	4	4	10		
	Five Mile Clwtr River	1974–1983	3	3	3	3	3	3	1	
	Foraker River	1995–1996							2	
	Fortin Lake Outlet	1968–1984						1	2	
	Fortymile River	1960–1995	1	2				4	2	
	Fourth Of July Creek	1975–1985						1	1	
	French Creek	1994		1						
	Garnet Creek	1960–1974						2		
	Geiger Creek	2000	1	1						
	George Creek	1976						1		
	Gerstle River	1976						1		
	Gisasa River	1959–2004	26	22				10	1	
	Glacier Creek	1997–2002	1	2	3				1	
	Gladys River	1955–2000	7					3	1	
	Glenlyon River	1972–1985	2					1		
	Goodpaster River	1954–2004	27	13				12	1	
	Goodpaster River (south fork)	2001–2004	2	1						
	Goodpaster Slough	1974						1		
	Grant Creek	1991		1	1					
	Grayling Creek	1976–2001	1	2	1			1	1	
	Grayling Fork Black River	1985		1						
	Hadweenzic River	1976–1985		1				1		
	Hammond River	1971–1997	2	1				2	5	
	Hayes River	1955–1972						2		
	Healy Creek	1996		1	1				1	
	Henshaw Creek	1960–2002	21	21				4	1	
	Hess Creek	1973						1		
	Hess River	1973–1983						1	1	
	High Creek	1996		1						
	Hodzana River	1960–1985		2				2		
	Hogatza River	1960–1998	12	21				7	3	
	Hoole River	1968–1990	8					1	1	
	Hot Slough	2004		1	1					
	Hult Creek	1991–2004	1	6	5			1	1	

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Area	Stream	Year Range ^a	Number of Surveys With Counts of						Unknown Salmon	No. Fish
			Chinook	Chum	Coho	Pink	Sockeye			
Yukon	Huslia River	1975–1990		1					1	1
	Iditarod River	1974–1992	1	1	1				2	1
	Illinois Creek	1960–1998	1	1	3				1	2
	Indian River	1960–1993	6	8					4	
	Innoko River	1981–1999	1	2	1		1			2
	Jennings River	1955–2000	12						2	
	Jim River	1960–2002	29	25	1				8	
	John River	1960–1992	1						3	1
	Johnson River	1976–1977							2	
	Julius Creek	1972–2002	9	12	15	2	2		5	4
	June Creek	1984–2002		3	7					1
	Kako Creek	1957–1972	1	2					3	
	Kala Creek	1960–1977	2	1					2	
	Kaltag River	1958–1991	5	5					5	
	Kandik River	1956–2002	3	1	1				5	4
	Kantishna River	2004		1	1					
	Kanuti River	1969–1985	1	1					2	2
	Kateel River	1959–1998	10	10	1				6	1
	Kliktentotza	1996		1						
	Klondike River	1956–1987	9	1					4	3
	Kluane River	1961–2003	8	32					9	7
	Koidern River	1977–1995	2	11	1	1			1	5
	Kokrines Str	1958	1	1					1	
	Koyukuk River	1960–1971	2	1					3	
	Koyukuk River Middle Fork	1969–1992	6	5					3	4
	Koyukuk River North Fork	1971–1992	4	2					1	
	Koyukuk River South Fork	1960–2002	29	26	1				9	3
	Kozherevsky River	1957–1959							2	
	Ladue River	1980–1992							1	1
	Lake Laberge	1975–1976	2						2	
	Lansing River	1983								1
	Lapie River	1969–1985	2							3
	Lewis Lake Outlet	1972–1990	7						1	
	Lignite Creek	2000–2002		1	3					
	Lignite Spring	1978–1999	1	4	7	1	1		1	
	Little Black River	1985								1
	Little Delta River	1995		1						
	Little Gerstle River	1976–1977							2	
	Little Kalzas River	1972–1985	3						1	
	Little Salcha River	1953–1973	1	1					3	
	Little Salmon River	1968–2003	31	2					9	4
	Lockwood Creek	1957	1	1		1			1	
	Lost Slough	1973–2002	9	19	27	7	7		8	1
	MacIntyre Creek	1993	1							
	Macmillan River, North Fork	1968–1983	1						3	1
	Macmillan River, South Fork	1968–1983	5						3	1
	Marsh Lake	1974	1						1	
	Mayo River	1968–1985	5						3	1

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Area	Stream	Year Range ^a	Number of Surveys With Counts of						Unknown Salmon	No. Fish
			Chinook	Chum	Coho	Pink	Sockeye			
Yukon	McDonald Creek	1980–2004	5	1	1				1	
	McKinley River	1974–2004	1	3	2				2	2
	M'Clintock River	1955–1983	8						8	
	McManus Creek	2003	1	1						
	McQuesten River	1974–1987	7						2	2
	Melozi Hot Springs Creek	1994–1998	5	5	1					
	Melozitna River	1959–1993	13	17					8	4
	Michie Creek	1993	1							
	Miner River	1972–1985	2	2					2	1
	Minook Creek	1958–1992	1	3					2	1
	Mission Creek	1956–1975							2	
	Moose Creek	1996–2004	1	1	1					1
	Moose River	1968–1983	1						1	1
	Morelock Creek	1960–1978	1	1					2	
	Morley River	1955–2000	18	1					7	
	Mountain Village	1956–1994	11	10	1	5	1		8	1
	Nabesna River	1976–1977							2	
	Nageethluk River	1985	1	1						
	Nation River	1956–2002	3	1	1				5	2
	Nelson Clearwater Creek	1974							1	
	Nenana River	1974–2002	1	7	13	1	1		1	
	Ninemile River	1959							1	
	Nisling River	1983	1							
	Nisutlin River	1955–2003	35						14	1
	Nordenskiold River	1969–1987	5						5	2
	Nowitna River	1960–1987	1	1					2	
	Nulato River	1958–2004	26	23					10	
	Nulato River, South Fork	1998–2004	4							
	Ollie Lakes and Outlet	1968–1972	2							
	Onemile Slough	1973–2004	8	24	8				8	
	Orchay River	1968							1	
	Otter Creek	1985–2004	3	1	1					
	Panguingue Creek	1978–1994	1	1	4	1	1		1	
	Pastolik River	1960–1982				1			1	
	Pearse Slough	1975–2002		8	1				2	
	Pelly Lakes & Outlet Stream	1968–1984	4						2	1
	Pelly River	1968–1983	4						2	1
	Piledriver Slough	1974–1984	1	1					2	1
	Pleasant Creek	1968–1985	2						2	1
	Pocahontas Creek	1991–1993	1	2	1					
	Preacher Creek	1996		1					1	
	Prevost River	1973–1986	2						1	2
	Rapid River	1985								1
	Ray River	1969–1973							2	
	Red Mountain Creek	1974								1
	Richardson Clearwater River	1962–2004	9	16	22	9	9		10	1
	Robertson River	1976							1	
	Rodo River	1959–1997	16	16	1				8	

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Appendix A1.–Page 11 of 11.

Area	Stream	Year Range ^a	Number of Surveys With Counts of						Unknown Salmon	No. Fish
			Chinook	Chum	Coho	Pink	Sockeye			
Yukon	Rogue River	1968						1		
	Ross River	1968–1996	17					2	3	
	Russell Creek	1972–1983	2					1	1	
	Salcha River	1954–2002	43	42	1	1	1	22	7	
	Salchaket Slough	1976–1997	1					2		
	Salmon Fork	1973–1999	6	7				6		
	Salmon Trout River	1960–1985	3	3				5	1	
	Sam Creek	1974–1976						2		
	Schieffelin Creek	1960						1		
	Sears Creek	1976						1		
	Seventeenmile Slough	1974–2002	19	25	26	8	8	8	2	
	Seventymile River	1963–1997	1	1	1			2	2	
	Sheenjek River	1960–1991	9	18	3	2	2	9		
	Sheldon Lake Outlet	1972–1981	2					1		
	Simon Creek	1959–1990	1	2				2		
	Slate Creek	1971–1996	2	2	1			2	4	
	South Bank Tanana River	1970–1994	9	16	1	1	1	11	1	
	Spruce Creek	1957	1	1				1		
	Squaw Creek	1974	1	1				1		
	Stewart River	1973–1980						2	1	
	Stink Creek	1976	1	1				1		
	Stuyahok River	2003	1	1						
	Sushana River	2000	1	1						
	Swift River	1969–2004	14	1				3	2	
	Takhini River	1958–1989	21					13		
	Tanana River	1962–2003	6	25	7	1	1	9		
	Tatchun Creek	1966–1998	16					4		
	Tatonduk River	1985–1997	1	2	1				1	
	Teklanika River	1989–2002	1	2	9				1	
	Teklanika River Springs	2000	1	1						
	Teslin River	1984–2003	4	14					1	
	Thanksgiving Creek	1985							1	
	Timber Creek	1993							1	
	Tincup Creek	1984–2000	14	1						
	Toklat River	1984–2004		21	21			1	8	
	Tozitna River	1985–2002	13	14	2	1	1			
Walker Creek	1996		1	1						
Wheeler Creek	1995	1	1							
White Creek	1991–1996		2	2				1		
White River	1984–1992		2					4		
Whitestone Slough	2004		1	1						
Wolf River	1984–2003	19								
Wood Creek	2000–2002		2	3						
Yellow River	1985–2001	1	1	1						
Yukon River (Canada)	1984–2003	1	19							

Note: Streams that are blank indicate that no data are available.

^a Represents the first and last year surveyed but not necessarily all years in between.

Appendix A2.—Escapement count projects (weir, tower, sonar, etc.) in AYK and years of data in the AYK salmon database management system.

Area and Location	Project Type	Range of Years ^a	Range of						Unkown ^b		Not In ^c Database
			Chinook	Chum	Coho	Pink	Sockeye	Salmon	Species		
Kotzebue:											
Noatak River	Sonar	1981–1998		7		6		1			
Squirrel River	Counting Tower	1982–1984								2	
Kuskokwim:											
Aniak River	Sonar	1980–2004	1	16	1	1	1	3	6		
George River	Weir	1996–2004	9	9	9	9	9				
Goodnews Middle Fork River	Counting Tower	1981–1990	10	10	8	9	10				
Goodnews Middle Fork River	Weir	1991–2004	14	14	14	9	14				
Kanektok River	Counting Tower	1996–1997	2	2	1	1	2	1		1	
Kanektok River	Sonar	1982–1987	4	4	3	2	4	2			
Kanektok River	Weir	2001–2004	4	4	4	4	4				
Kogruklu River	Counting Tower	1969–1978	9	9	1		9				
Kogruklu River	Weir	1976–2004	29	29	23	1	29				
Kuskokwim River	Sonar	1993–1995	3	3	3	3	3				
Kwethluk River	Counting Tower	1996–1999	4	4	4	4	4				
Kwethluk River	Sonar	1978–1979								2	
Kwethluk River	Weir	1992–2004	6	6	6	6	6				
Salmon River	Weir	1981–1982	2								
Takotna River	Counting Tower	1995–1998	3	4							
Takotna River	Weir	2000–2004	5	5	5		5				
Tatlawiksuk River	Weir	1998–2004	7	7	6	7	7				
Tuluksak River	Weir	1991–2004	8	8	8	8	8				
Norton Sound:											
Chirosky River	Counting Tower	1975–1976								2	
Eldorado River	Counting Tower	1995–2001	7	7	7	6					
Eldorado River	Weir	2002–2004	3	3	3	2					
Glacial Lake	Weir	2000–2004		1			5				
Kachauvik River	Counting Tower	1977–1978								2	
Kwiniuk River	Counting Tower	1965–2004	25	40	8	39					
Niukluk River	Counting Tower	1979–2004	10	11	10	11					
Nome River	Counting Tower	1993–1995	3	3	3	3					
Nome River	Weir	1996–2004	9	9	9	9					
North River	Counting Tower	1972–2004	15	15	10	15				1	
Nunavulnak River	Counting Tower	1992								1	
Pikmiktalik River	Counting Tower	1992–2004	2	2	2	2				1	
Shaktoolik River	Counting Tower	1996–1998	3	3	3	3					
Snake River	Counting Tower	1995–2001	6	7	7	7					
Snake River	Weir	2002–2004	3	3	3	3					
Tubutulik River	Counting Tower	1980								1	
Unalakleet River	Sonar	1983–1985								3	
Pt. Clarence:											
Pilgrim River	Counting Tower	1997–2002	3	2	3	3	2	1			
Pilgrim River	Weir	2003–2004	2	2	2	2	2				

-continued-

Appendix A2.—Page 2 of 2.

Area and Location	Project Type	Range of Years ^a	Range of					Unkown ^b		Not In ^c Database
			Chinook	Chum	Coho	Pink	Sockeye	Salmon	Species	
Yukon:										
Andreafsky River, East Fork	Counting Tower	1986–1988	3	3		3				
Andreafsky River, East Fork	Sonar	1981–1985		1				4		
Andreafsky River, East Fork	Weir	1994–2004	11	10	10	4	4			
Anvik River	Counting Tower	1972–1976	5	5		3				
Anvik River	Sonar	1979–2003		25						
Barton Creek	Weir	1994–1996		3	3					
Beaver Creek	Weir	1996–2000	4	4	2					
Blind Creek	Weir	1997–2000								4
Chandalar River	Sonar	1986–2003		14						
Chandindu River	Weir	1999–2004								6
Chatanika River	Counting Tower	1998–2002	5	5						
Chena River	Counting Tower	1993–2003	11	11						
Clear Creek	Counting Tower	1995–2000		5						
Clear Creek	Weir	2001–2004		4						
Fishing Branch River	Weir	1972–2003		22						
Gisasa River	Weir	1994–2003	10	10		3	1			
Henshaw Creek	Weir	1999–2004	5	6						
Kaltag River	Counting Tower	1994–2004	10	9						
Koyukuk River South Fork	Sonar	1990		1						
Koyukuk River South Fork	Weir	1996–1999	3	3	2					
Melozitna River	Sonar	1981–1983		3						
Nulato River	Counting Tower	1994–2003	9	9						
Salcha River	Counting Tower	1993–2003	11	9						
Sheenjok River	Sonar	1981–2003		23						
Tanana River	Sonar	1981								1
Tatchun Creek	Weir	1997–2000								4
Toklat River	Sonar	1994–1996		3						
Tozitna River	Counting Tower	1994–1996								3
Tozitna River	Weir	2002–2004								3
Whitehorse Fishway	Counting Tower	1959–2004								45
Yukon River at Eagle	Sonar	1992–1994								3
Yukon River at Pilot Station	Sonar	1986–2003	16	16	16	8				

Note: Projects that are blank indicate that no data are available.

^a Represents the first and last year surveyed but not necessarily all years in between.

^b Unknown salmon are those counts that are known to be salmon but not which species of salmon. Unknown species are known to be fish but not which species of fish.

^c Represents a project for which data have not been loaded into the AYK salmon DBMS. Most are single year projects, projects discontinued after found unfeasible, or operated in Canada and for which data have been requested.

APPENDIX B.

Appendix B1.—Example of project listings in AYK salmon database management system.

Project Summary

Stream Site	current	Year(s)	Contact	Agency	Division
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Area M

<i>Area M Mark/Recapture</i>	<input type="checkbox"/>	1960, 1987	Jim Menard	ADFG	CF
------------------------------	--------------------------	------------	------------	------	----

Tagged salmon were caught from the Area M release in 1960 and 1987 by ADF&G.

Boston Creek

<i>Boston Creek Carcass Sample</i>	<input type="checkbox"/>	1978	Jim Menard	ADFG	CM
------------------------------------	--------------------------	------	------------	------	----

The ADF&G Commerical Fisheries division collected carcass samples at Boston Creek in 1978.

Chirosky River

<i>Chirosky River Tower</i>	<input type="checkbox"/>	1975 - 1976	Jim Menard	ADFG	CF
-----------------------------	--------------------------	-------------	------------	------	----

In 1975 and 1976, a counting tower on the Chirosky River was operated by ADF&G. The purpose of this tower was to determine indices for chinook and chum salmon abundance and run timing for the Unalakleet River. Project personnel enumerated escapement into the Chirosky and provided a base line of data for that river, but the tower was discontinued in 1977 because the site did not reflect escapement for the whole Unalakleet River.

Eldorado River

<i>Eldorado Tower</i>	<input type="checkbox"/>	1995 - 1998	Timothy Kroeker	ADFG, KC	CF
-----------------------	--------------------------	-------------	-----------------	----------	----

In 1995, the Kawerak Corporation initiated a counting tower project on the Eldorado River in cooperation with ADF&G, BSFA, Sitasuak Corporation, and Nome Eskimo. The project provides daily and seasonal run timing and magnitude estimates for chinook, chum, pink, and coho salmon.

Additional History: ADFG, BSFA,SC,NE; one 15' tower on unspecified bank and deflection weir

-continued-

Stream Site	current	Year(s)	Contact	Agency	Division
<i>Eldorado Weir</i>	<input checked="" type="checkbox"/>	1999 - Present	Timothy Krockner	ADFG, KC	CF
<p>Used for determining daily and seasonal timing and magnitude of escapements. Midseason, counting tower converted to a fixed weir. Cooperative project operated by Kawerak Inc. with assistance from ADFG, and funded by Kawerak Inc., BSFA, NSI, and NSEDC.</p>					
Fish River					
<i>Fish River Radiotelemetry</i>	<input checked="" type="checkbox"/>	2003 - Present	Gary Todd	ADFG	CF
<p>Project operated from 2002-2004, and was funded by Norton Salmon Sound Research and Restoration Initiative and ADF&G Commercial Fisheries Division. Main project goals were to determine if Niukluk River counting tower counts could be used to estimate the whole drainage (Fish River) chum salmon escapement, locate major spawning areas, and determine if escapement is one stock or multiple sub-stocks (i.e. if Niukluk is separate). Radiotelemetry and mark-recapture methodologies were employed. Preliminary results have approximately 30-35% yearly of the chum escapement going into the Niukluk River. Project estimated Fish River drainage chum salmon population by using Niukluk River counting tower as recapture location and expanding tower counts. Drainage distribution (proportion) and spawning areas were located on tributaries, and migration timing and rates were also estimated. escapement is one stock or some sub-stocks (is Niukluk separate). Radiotelemetry and mark-recapture methodologies were employed. Preliminary results have approximately 30-35% yearly, of the chum escapement going into the Niukluk River. Project estimated Fish River drainage chum salmon population by using Niukluk River counting tower as recapture location and expanding tower counts. Drainage distribution (proportion) and spawning areas were located on tributaries, and migration timing and rates were also estimated.</p>					
Glacial Lake					
<i>Glacial Lake Weir</i>	<input checked="" type="checkbox"/>	1979, 2000 - Present	Dave Parker	BLM	NONE
<p>In 1979 the Glacial Lake weir was operated by the Nome High School and in 2000 BLM reinstated the project. The weir monitors salmon escapement into Glacial Lake. Information from the Glacial Lake weir project can be obtained from BLM.</p>					

APPENDIX C.

Yukon Area Chinook Salmon Age, Sex and Size Data

Metadata also available as

- Identification_Information
- Metadata_Reference_Information

Identification_Information:

Citation:

Citation_Information:

Originator:

Alaska Department of Fish and Game, Commercial Fisheries, Region III

Publication_Date: Unpublished Material

Publication_Time: Unknown

Title: Yukon Area Chinook Salmon Age, Sex and Size Data

Geospatial_Data_Presentation_Form: Database

Description:

Abstract:

Biological data collected since circa 1960- present. Raw data consists primarily of information about the age, sex and length of Chinook salmon. Location data always refers to a somewhat general area where a certain project took place and is never as specific as a lat and long of where the fish were sampled.

Purpose:

To assist managers and researchers in making intelligent decisions regarding subsistence and commercial fishing policies.

Time_Period_of_Content:

Time_Period_Information:

Range_of_Dates/Times:

Beginning_Date: 1960

Beginning_Time: Unknown

Ending_Date: 2003

-continued-

Ending_Time: Unknown

Currentness_Reference: ground condition

Status:

Progress: In Work

Maintenance_and_Update_Frequency: Annually

Spatial_Domain:

Description_of_Geographic_Extent: Yukon River Drainage

Keywords:

Theme:

Theme_Keyword_Thesaurus: NBII Biocomplexity Thesaurus

Theme_Keyword: fishery management

Theme_Keyword: fishery research

Theme_Keyword: commercial fishing

Theme_Keyword: age groups

Theme_Keyword: age composition

Theme_Keyword: length

Theme_Keyword: sex

Theme:

Theme_Keyword_Thesaurus: none

Theme_Keyword: subsistence

Theme_Keyword: test fishery

Theme_Keyword: gillnet

Theme_Keyword: fish wheel

Theme_Keyword: beach seine

Theme_Keyword: carcass

Theme_Keyword: escapement

Theme_Keyword: weir

Theme_Keyword: tower

Theme_Keyword: length composition

Place:

Place_Keyword_Thesaurus: None

-continued-

Place_Keyword: Yukon

Place_Keyword: Alaska

Place_Keyword: River

Place_Keyword: Drainage

Taxonomy:

Keywords/Taxon:

Taxonomic_Keyword_Thesaurus: Integrated Taxonomic Information

Taxonomic_Keywords: Chinook

Taxonomic_Keywords: salmon

Taxonomic_Keywords: king

Taxonomic_System:

Taxonomic_Procedures: visual species identification

Taxonomic_Classification:

Taxon_Rank_Name: Kingdom

Taxon_Rank_Value: Animalia

Taxonomic_Classification:

Taxon_Rank_Name: Phylum

Taxon_Rank_Value: Chordata

Taxonomic_Classification:

Taxon_Rank_Name: Subphylum

Taxon_Rank_Value: Vertebrata

Taxonomic_Classification:

Taxon_Rank_Name: Superclass

Taxon_Rank_Value: Osteichthyes

Taxonomic_Classification:

Taxon_Rank_Name: Class

Taxon_Rank_Value: Actinopterygii

Taxonomic_Classification:

Taxon_Rank_Name: Subclass

Taxon_Rank_Value: Neopterygii

-continued-

Taxonomic_Classification: Taxon_Rank_Name: Infraclass

Taxon_Rank_Value: Teleostei

Taxonomic_Classification:

Taxon_Rank_Name: Superorder

Taxon_Rank_Value: Protacanthopterygii

Taxonomic_Classification:

Taxon_Rank_Name: Order

Taxon_Rank_Value: Salmoniformes

Taxonomic_Classification:

Taxon_Rank_Name: Family

Taxon_Rank_Value: Salmonidae

Taxonomic_Classification:

Taxon_Rank_Name: Subfamily

Taxon_Rank_Value: Salmoninae

Taxonomic_Classification:

Taxon_Rank_Name: Genus

Taxon_Rank_Value: Oncorhynchus

Taxonomic_Classification:

Taxon_Rank_Name: Species

Taxon_Rank_Value: Oncorhynchus tshawytscha

Applicable_Common_Name: Chinook salmon

Applicable_Common_Name: Chinook salmon or king salmon

Applicable_Common_Name: salmon Chinook

Access_Constraints: Must contact the Regional Research Biologist

Use_Constraints: Must contact the Regional Research Biologist

Point_of_Contact:

Contact_Information:

Contact_Person_Primary:

-continued-

Contact_Person: Regional Research Biologist

Contact_Organization: Alaska Department of Fish and Game

Contact_Position: Regional Research Biologist

Contact_Address:

Address_Type: mailing and physical address

Address: 333 Raspberry Rd

City: Anchorage

State_or_Province: AK

Postal_Code: 99518

Country: USA

Contact_Voice_Telephone: 907 267-2109

Contact_Facsimile_Telephone: 907 267-2442

Hours_of_Service: 0800 - 1630

Cross_Reference:

Citation_Information:

Title: Kuskokwim Area Chinook Salmon Age, Sex and Size data

Cross_Reference:

Citation_Information:

Title: Norton Sound Area Chinook Salmon Age, Sex and Size data

Metadata_Reference_Information:

Metadata_Date: 20041025

Metadata_Review_Date:

Metadata_Future_Review_Date:

Metadata_Contact:

Contact_Information:

Contact_Person_Primary:

Contact_Person: Regional Research Biologist

Contact_Organization: Alaska Department of Fish and Game

-continued-

Contact_Position: Regional Research Biologist

Contact_Address:

Address_Type: mailing and physical address

Address: 333 Raspberry Rd

City: Anchorage

State_or_Province: AK

Postal_Code: 99518

Country: USA

Contact_Voice_Telephone: 907 267-2109

Contact_Facsimile_Telephone: 907 267-2442

Hours_of_Service: 0800 - 1630

Metadata_Standard_Name:

FGDC Biological Data Profile of the Content Standard for Digital Geospatial Metadata

Metadata_Standard_Version: FGDC-STD-001.1-1999

Metadata_Time_Convention: local time

Source: Generated by [mp](#) version 2.8.17 on Friday, February 11, 14:01:38, 2005.

Electronic Metadata Interview

1. Have you already prepared metadata for this data set? *No*^a
 - a. If yes, please send a copy of the documentation or a reference to where it can be found and skip to item 17.
 2. What is the title of the data set? *Kuskokwim Area Chinook Salmon Age, Sex, and Size Data*
 3. Who is the originator(s) owner of the data set? (Include address and telephone number).
 - a. If someone else should answer questions about the data, please list the name, address, and telephone number.
 - b. Are there other organizations or individuals who should get credit for support, funding, or data collection and analysis?

*Alaska Department of Fish and Game, Division of Commercial Fisheries, Region III
Regional Research Biologist
333 Raspberry Rd.
Anchorage, AK 99518
Voice Telephone: 907 267-2109
Facsimile_Telephone: (907) 267-2442
Hours_of_Service: 0800 - 1630*
 4. Is the data set published or part of a larger publication?
 - a. If so, what is the reference?
 5. Include a brief (no more than a few sentences) description of the data set.
 6. Why were the data collected in the first place?
 7. What is the time period represented by the data set?
 8. Were the data developed primarily through:
 - a. Field visits?
 - b. Remote instrumentation (i.e. temperature recorders, etc).
 - c. Existing data sources?
 9. What is the status of the data set you are documenting? – complete, in progress, planned.
 - a. Will the data set be updated? If so, how frequently?
 10. Where were the data collected? Include description and coordinates, if known.
-

11. List some keywords to help search for this data set.
 - a. Thematic, Place, Temporal, Strata, Taxonomy.
 - b. If a controlled vocabulary was used, what is the reference?
12. List any related data sets that could be documented for cross reference.
13. The FGDC Biological Profile includes the means to document tabular data sets, taxonomy, field methods, and the use of analytical tools or models.
 - a. Was your data set developed using a model or other analytical tool?
 - i. If so, what is the reference?
 - ii. If the model or tool is available include a contact and/or URL.
 - b. Does the data set contain biological information? If no, skip to item 14.
 - i. What species or communities were examined?
 - ii. Did you use a taxonomic authority or field guide for identification?
 1. If so, what is the reference?
 - iii. Briefly summarize your field methods (cut & paste from other documents!)
 1. If you used existing protocols or methods, list the references.
14. Is your data set archived in a databank or data catalog? If yes, please include a reference to the documentation and skip to item 15. If No:
 - a. What measures did you take to make certain that your data set was as nearly correct as possible?
 - b. Were there any things that you excluded from your data collection? Stems less than a certain diameter or streams without surface flow.
 - c. What is the form of your data set? Spreadsheet, ASCII file, GIS layer, database, other.
 - d. What is the filename for you data set?
 - i. For each file or table, list the fields in the data set and for each field list.
 - ii. The definition of the field.
 - iii. If the data are coded (Enumerated Domain) list the codes and the definitions.
 - iv. If the codes come from a published code set (Code set Domain), list the references.
 - v. If the data are measured (Range Domain), list the units and the minimum and maximum allowable values. (“no limit” is acceptable).
 - vi. Otherwise, the domain is un-representable. Include a brief description of what is in the field.
15. Is the data set available for distribution? If no, go to 17
 - a. Are there legal restrictions on who may use the data?
 - b. Do you have advice for potential users of the data set?
 - c. What are your distribution instructions?
16. You are done. Send a text file containing the responses to this interview to your metadata coordinator.

^a Italicized text represents sample answers.