Special Publication No. 05-04

Development of the Arctic-Yukon-Kuskokwim Salmon Database Management System Through 2004

Annual Report for Project 04-11, *Norton Sound Salmon Information Database*
Norton Sound Salmon Research and Restoration
Fishery Disaster Relief Program for Norton Sound, Alaska

by

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March 2005

Alaska Department of Fish and Game **Divisions of Sport Fish and Commercial Fisheries**

Symbols and Abbreviations

The following symbols and abbreviations, and others approved for the Système International d'Unités (SI), are used without definition in the following reports by the Divisions of Sport Fish and of Commercial Fisheries: Fishery Manuscripts, Fishery Data Series Reports, Fishery Management Reports, and Special Publications. All others, including deviations from definitions listed below, are noted in the text at first mention, as well as in the titles or footnotes of tables, and in figure or figure captions.

Weights and measures (metric)

centimeter	cm
deciliter	dL
gram	g
hectare	ha
kilogram	kg
kilometer	km
liter	L
meter	m
milliliter	mL
millimeter	mm

Weights and measures (English)

cubic feet per second	ft^3/s
foot	ft
gallon	gal
inch	in
mile	mi
nautical mile	nmi
ounce	oz
pound	lb
quart	qt
yard	yd

Time and temperature

day	d
degrees Celsius	°C
degrees Fahrenheit	°F
degrees kelvin	K
hour	h
minute	min
second	s

Physics and chemistry

all atomic symbols	
alternating current	AC
ampere	A
calorie	cal
direct current	DC
hertz	Hz
horsepower	hp
hydrogen ion activity (negative log of)	pH
parts per million	ppm
parts per thousand	ppt, ‰
volts	V
watts	W

General

Alaska Administrative Code	AAC
all commonly accepted abbreviations	e.g., Mr., Mrs., AM, PM, etc.
all commonly accepted professional titles	e.g., Dr., Ph.D., R.N., etc.
at	@
compass directions:	
east	E
north	N
south	S
west	W
copyright	©
corporate suffixes:	
Company	Co.
Corporation	Corp.
Incorporated	Inc.
Limited	Ltd.
District of Columbia	D.C.
et alii (and others)	et al.
et cetera (and so forth)	etc.
exempli gratia (for example)	e.g.
Federal Information Code	FIC
id est (that is)	i.e.
latitude or longitude	lat. or long.
monetary symbols (U.S.)	$, ¢
months (tables and figures): first three letters	Jan,...,Dec
registered trademark	®
trademark	™
United States (adjective)	U.S.
United States of America (noun)	USA
U.S.C.	United States Code
U.S. state	use two-letter abbreviations (e.g., AK, WA)

Measures (fisheries)

fork length	FL
mideye-to-fork	MEF
mideye-to-tail-fork	METF
standard length	SL
total length	TL

Mathematics, statistics

all standard mathematical signs, symbols and abbreviations	
alternate hypothesis	H_A
base of natural logarithm	*e*
catch per unit effort	CPUE
coefficient of variation	CV
common test statistics	(F, t, χ^2, etc.)
confidence interval	CI
correlation coefficient (multiple)	R
correlation coefficient (simple)	r
covariance	cov
degree (angular)	°
degrees of freedom	df
expected value	*E*
greater than	>
greater than or equal to	≥
harvest per unit effort	HPUE
less than	<
less than or equal to	≤
logarithm (natural)	ln
logarithm (base 10)	log
logarithm (specify base)	$\log_2$, etc.
minute (angular)	'
not significant	NS
null hypothesis	H_O
percent	%
probability	P
probability of a type I error (rejection of the null hypothesis when true)	α
probability of a type II error (acceptance of the null hypothesis when false)	β
second (angular)	"
standard deviation	SD
standard error	SE
variance	
population	Var
sample	var

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March 2005

Development and publication of this manuscript was partially financed by the NOAA Cooperative Agreement NA16FW1272 for Project 04-11 Norton Sound Salmon Information Database.

The Division of Sport Fish Special Publications series was established in 1991 for the publication of techniques and procedures manuals, informational pamphlets, special subject reports to decision-making bodies, symposia and workshop proceedings, application software documentation, in-house lectures, and other documents that do not fit in another publication series of the Division of Sport Fish. Since 2004, the Division of Commercial Fisheries has also used the same Special Publication series. Special Publications are intended for fishery and other technical professionals. Special Publications are available through the Alaska State Library and on the Internet: http://www.sf.adfg.state.ak.us/statewide/divreports/html/intersearch.cfm. This publication has undergone editorial and peer review

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This document should be cited as:
Brannian, L.K., S. Darr, H.A. Moore, and S. StClair. 2005. Development of the Arctic-Yukon-Kuskokwim salmon database management system through 2004. Alaska Department of Fish and Game, Special Publication No. 05-04, 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 the second year of funding from the Fishery Disaster Relief Program for Norton Sound (NOAA NA16FW1272) which supports Norton Sound components of the AYK salmon DBMS. During this period 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). Data entry, editing, and reporting systems developed to date were demonstrated to users August and November 2004. A scope of work was completed in September 2004. Staff was trained in Metadata standards, metadata software was purchased and a metadata framework was created. 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), and the Alaska Department of Fish and Game (ADF&G) general funds and other federal grants, specifically the Norton Sound Salmon Research and Restoration fund (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, $300,000 project to create a salmon database management system for AYK to USFWS OSM. This proposal was rejected because of its cost and duration, and instead a one year $60,000 pilot project (FIS 00-016) was funded. The specific objectives of project FIS 00-016 were to (1) create an inventory of existing salmon data sources, and, (2) to conduct a preliminary needs assessment survey of fisheries managers and researchers in the AYK Region. As part of this effort, historical and current AYK salmon projects were described and primary contact information (agency, project leader, etc.) was included (Hamner et al. 2002). An inventory of project associated data was created to include electronic filename, file type, project type, location, species, and data descriptions. As part of the project a summary of the results of an informal survey of State and Federal fisheries management and research staff, was included. This summary identified data sets and data summaries required to make more informed fishery management decisions. First steps in creating a database of historical and current salmon data were the inventory and survey. In the early stages of the project it became apparent that a thorough inventory could not be completed within the allotted timeframe and funding, mostly because of the discovery of large quantities of disorganized data.

Supplemental funding was sought to assist in continuing work on the salmon database management system for AYK. Sources included OSM, federal disaster relief funds appropriated for the purpose of restoration and rehabilitation of Norton Sound salmon populations, National Oceanic and Atmospheric Administration (NOAA), and the AYK Sustainable Salmon Initiative (AYK SSI) representing a portion of the federally appropriated Pacific Salmon Recovery fund. Two OSM proposals were approved for funding. Project FIS 02-069 for the period 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 this second year, ASL data not found as electronic files were reentered from handwritten forms into the ASL database. Although these funds are allocated specifically for Norton Sound, applications and database structures developed for the Norton Sound area are useful in other areas of the region since data collection follows a standard protocol across the region.

Additional funding was requested after discovering a significant number of ASL electronic files had been lost 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

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

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 the Norton Sound Salmon Research and Restoration fund (project 04-11 *Norton Sound Information Database*). Beginning July 1, 2004 the USFWS OSM has 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, 2003 to June 30, 2004. These objectives represent project 04-11, *Norton Sound Information Database* as described in the 5 year project description prepared December 2003 and include:

1. Create metadata for inventoried data according to standards for biological data set by the National Biological Information Infrastructure (NBII), a division of the U.S. Geological Survey (USGS) and as requested by the Norton Sound Technical Committee.
2. Update all escapement and ASL data to current year.
3. Develop intermediate data entry, editing and reporting systems so that data can continue to be added, edited and reported.
4. Recheck escapement data for errors.
5. Develop a georeferenced Access database of projects containing information about project descriptions, associated electronic data files, and reports.

6. Create a web map interface in which location, text and photo description of projects that can be queried.
7. Complete and document a plan of software development and scope of work for the entire project, including an Internet accessible database.
8. Load Access databases into SQL Server purchased in FY2003.
9. Demonstrate the Access databases and reporting capabilities to users.
10. Distribute CDs with Access databases to researchers.

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 data. Additional datasets scheduled to be included as time allows before June 30, 2007 or during the second phase ending June 30, 2009 include the remaining test fish data for AYK and tagging data from projects conducted by AYK Region CF.

Two datasets maintained by ADF&G staff outside the AYK Region are of priority interest (Hamner et al. 2002) to potential AYK 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 Access[2] 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 was 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 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) will be purchased with funds from project FIS 04-704, one database server and one web server. The database server will reside behind the State's firewall and house all of AYK's data within a Microsoft SQL Server 2000 database. The web server will be accessible from the Internet and provide public or agency access to AYK data, and to serve as a secured portal for AYK staff to access their data. The server purchased under NSSRR will then be freed to serve three ways: as purely an Intranet server, as a replicated database server, and as a testing server. All servers will be backed up nightly using existing equipment on the 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 2002 is an Integrated Development Environment (IDE) that allows programmers to develop native Windows and web applications that run on the .NET framework. Most future interface development (barring

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

Access work) will be done in Visual Studio .NET, and some development has already begun with Yukon River subsistence survey data. Microsoft Visual Studio .NET Professional 2003 will be purchased to (1) provide adequate license coverage and (2) take advantage of 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 will be 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 Norton Sound staff beginning June 2005. Final testing of the web component by AYK staff will begin March 2007. The web component in this phase will still be accessible only within the State's WAN. Only when all staff are satisfied with all group and individual 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 one year, scales are a permanent record of annual growth over the lifetime of an individual salmon. Salmon length is generally represented by a measurement to the nearest 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. They are stored in cabinets located in the Anchorage and Nome ADF&G offices. Paper copies of ASL data are filed in the same locations. In most years, ASL data were converted to electronic data files located on either mainframe or personal computers. However, no formal archiving system was established and much of the electronic data have been lost.

Our efforts to inventory (Hamner et al. 2002, 2003b, and 2004) ASL data have ended. All data that were found have been aggregated, standardized and prepared for loading into an intermediate Access database. Most ASL data have been loaded. Notable is a single "bankers" box of paper forms representing Yukon River chum and coho salmon data that remains to be hand entered.

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

[3] 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

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 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.

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

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 database management system until such time a link with the Division of Subsistence is agreed upon and developed.

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

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

TAGGING DATA

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

The Mark, Tag, and Age Laboratory of the Division of Commercial Fisheries provides detailed information about thermal marks induced in fish otoliths and maintains a centralized State 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 these data to this web site.

ENHANCEMENT DATA

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

METADATA

Metadata are a description of a dataset's content, quality, lineage, contact, condition, and other characteristics. The description of the data is organized in a standardized format using a common set of terms. Metadata 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. 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.

PROGRESS IN DEVELOPMENT OF THE AYK SALMON DBMS JULY 1, 2003–DECEMBER 15, 2004

During this reporting period we undertook tasks to fulfill objectives (page 3) for the Norton Sound component (Project 04-11) of the AYK salmon DBMS. Tasks involved (1) development of a scope of work for the AYK salmon DBMS, (2) development of a database comprised of project description information, (3) modification of existing databases that were then populated with Norton Sound ASL and escapement data through 2003 and (4) development of data entry, editing, and report applications for those databases. 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. 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 edit.

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 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 four aspects of the ASL component of the AYK salmon DBMS were addressed; database maintenance, data entry/loading, data editing, and application development. Much of the work directed towards ASL data until now was funded by other projects (Figures 2 and 3).

Database maintenance involved modification of the Access database and development of the database structure for the final centralized database in Microsoft SQL. The database structure for ASL data was revised to optimize data storage efficiency and compatibility with hypothetical future data structures. A database in Microsoft SQL was developed.

Data entry and data loading using programs continued into this reporting period. We searched, recovered, and loaded the remaining Norton Sound salmon ASL data from CD archives into the intermediate Access database. Data through 2003, representing all that has been found, was transferred to the Microsoft SQL database. A commercial firm was contracted to enter by hand AYK chum salmon ASL data. Only Yukon River chum and coho salmon ASL data remain to be hand entered and the forms reside in a single "bankers" box.

The only editing of data during this reporting period involved elements that we could accomplish without input from project biologists. 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. Data were modified to be in a consistent aging convention (European) and header information was checked and corrected. 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 the 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.

Approximately 3,550 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). Of that estimated total 81.4% or 2,888 files have been located and 96.5% (2,786) 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 90%).

ESCAPEMENT DATA

During this reporting period four aspects of the escapement component of the AYK salmon DBMS were addressed; data review, database maintenance, data entry/loading, and application

development. Data residing in the Access version of SASPOP were reviewed prior to modifying the structure of the Access version of SASPOP and loading all Norton Sound escapement count (tower, weir, sonar, etc) and escapement survey (boat, aerial, and foot) data through 2003. Programs were also written to load, edit, and extract data from this Access database.

ADF&G staff questioned the accuracy and completeness of the AYK escapement database in SASPOP (representing data through 1998). In response, escapement data in this database were checked against season escapement totals for each project site and species as recorded in annual regional information reports or spreadsheets maintained by project leaders if the data were not reported. Discrepancies were noted for further investigation. A total of 695 data sets were reviewed and 96 (14%) were found to contain discrepancies with season totals reported in ADF&G reports or project leader spreadsheets for those not reported (Table 5). Norton Sound datasets represented 33% (229) of those reviewed and for which discrepancies were found in 28. Season summary tables could not be found for 163 data sets (23%) contained in the database, so accuracy of these data could not be determined.

Database maintenance involved modifying the structure of the Access version of SASPOP to meet the needs of the AYK salmon DBMS. Many unused database fields and tables were deleted. Table and field names were maintained whenever possible in case another statewide attempt at database development was to occur. This modified database is now the Access version of the escapement (count and survey) component of the AYK salmon DBMS (Figure 5).

Norton Sound escapement survey data contained in approximately 100 spreadsheets were reformatted, standardized, and loaded into the AYK salmon DBMS (Access version). A program was written to reformat these Lotus and Excel spreadsheets so they could be loaded into the Access database. Count data through 2003 residing in spreadsheets were also loaded into the Access database. Norton Sound escapement survey data now ranges from 1959 through 2003. Norton Sound escapement count data ranges from 1965 through 2003.

PROJECT LISTING DATABASE

During this reporting period a project database in Access was created as the merging of the data inventory spreadsheet prepared by Hamner et al. (2002, 2003a) and a table within the escapement database listing all escapement projects. The project listing was updated to reflect data recovery progress in ASL, escapement count, and aerial survey data.

We developed a three tiered data structure for the project listing database and included features uniquely requested for Norton Sound (see Norton Sound Information Database project Objective 5 and 6, pages 3 and 4). 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 and all Norton Sound projects (Appendix A) 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.

A clickable map providing pictures and general information about Norton Sound escapement projects was also developed. The clickable web map (Figure 6) is only a prototype, but can be used to demonstrate how users might access project data. A feature would be constructed, to allow users to "drill down" to lists of data available for each project. The resulting data summaries could then be selected for access to specific data sets. The graphical map interface is useful because it allows an easily recognizable, geographically based clickable interface to otherwise esoterically organized data sets.

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.

Two AYK Information Technology (IT) staff members received training in NBII metadata at a 2 day seminar in Seattle, April 2004 sponsored by USGS to include funding for travel and per diem. This training included understanding, defining and creating NBII compliant metadata. The workshop also presented some of the tools available to create metadata and we chose to purchase one of the recommendations, SMMS version 5.1 (Table 1). Several of the templates that are used with SMMS software were built. We modified a questionnaire that will be given to Biologists requesting suggested keywords and descriptions that will aid in creating the metadata records.

A preliminary metadata structure was developed for use in 2004. Metadata structure for ASL data represents grouping by area (Kuskokwim, Yukon, Norton Sound/Port Clarence, or Kotzebue), species, and project type (e.g. Norton Sound, chum salmon, test fishing). A Metadata record will be developed at the level of area, species, and project for escapement count data (e.g. Norton Sound, chum salmon, and Nome River weir) and by area and species for escapement survey data.

DISCUSSION

Most objectives for the period from July 1, 2003 to June 30, 2004 of the Norton Sound Information Database project were fulfilled or significant progress was made towards their fulfillment. A scope of work was completed (Brannian et al. 2004), databases were populated with ASL and escapement data for Norton Sound salmon through 2003, and a project listing database was developed with a web map interface for Norton Sound projects. Data entry, editing, and reporting systems were developed and escapement data prior to 1999 were rechecked for errors. Progress was made in developing metadata for Norton Sound projects, data have been distributed to researchers upon request, and the AYK salmon DBMS has been demonstrated to users in Anchorage (August) and Nome (November).

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. In the future we intend to report our progress in developing the AYK salmon DBMS annually, one document, as a draft progress report in December and the final in May. We intend 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. This should culminate the development of one annual report satisfying reporting commitments for the two current sources of funding, NSSRR and USFWS OSM.

Though metadata have 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 will be completed by December 31, 2004 as a deliverable for the OSM funded component of the AYK salmon DBMS (Table 4). Metadata should not be considered complete prior to the end of this project, but should be updated annually. The complexity and detail provided in a metadata record may increase as we understand how it will be 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 should be addressed every year as an objective and presented to users annually for comment.

Though all Norton Sound and Kotzebue 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 during the next year 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.

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.

Previous timelines and objectives for the Norton Sound Information database project have been grossly over ambitious with the result being delays and missed deliverable deadlines. Lacking a scope of work, objectives were vague and datasets to be included were ill defined. It was assumed that when data were rescued and loaded it would be ready for distribution. An important and time consuming step of verifying and editing the database by knowledgeable biologists was omitted. It was also assumed that creation of the web assessable SQL database would be created in a single step, occurring in one year. We have found that each stage of development (intermediate databases, central SQL database, and web accessibility) should be stated separately in listings of annual objectives. We hope these problems will not recur again with acceptance of our scope of work and if objectives and deliverables for the Norton Sound component are more in line with the USFWS OSM component. Much work was done in preparing objectives and deliverable due dates when the cooperative agreement between USFWS and ADF&G was drafted July 2004. We feel they are achievable and will result in fulfillment of our scope of work, project goal and objectives by June 30, 2007. Previous estimates of time needed to develop applications were also grossly underestimated.

CONCLUSIONS FOR NORTON SOUND INFORMATION DATABASE OBJECTIVES

We conclude the following for the July 1, 2003 through June 30, 2004 objectives for the Norton Sound Information Database (04-11) project:

1. *Create metadata for inventoried data according to standards for biological data set by the National Biological Information Infrastructure (NBII).* This objective was not fulfilled though progress was made and we anticipate preliminary metadata completed by December 31, 2004.
2. *Update all escapement and ASL data to current year*. Objective fulfilled as intermediate Access databases were populated with data through 2003.
3. *Develop intermediate data entry, editing and reporting systems so that data can continue to be added, edited and reported*. Objective fulfilled, though work will continue to create data entry screens for aerial survey data and to incorporate user comments from the November user demonstration.
4. *Recheck escapement data for errors*. Objective fulfilled and corrections will be made to the database in 2005.
5. *Develop a georeferenced Access database of projects containing information about project descriptions, associated electronic data files, and reports*. Objective fulfilled.
6. *Create a web map interface in which location, text and photo description of projects that can be queried.* Objective fulfilled. During the November demonstration in Nome additional project photos were collected and will be incorporated.
7. *Complete and document a plan of software development and scope of work for the entire project, including an Internet accessible database*. Objective fulfilled by Brannian et al. (2004).
8. *Load Access databases into SQL Server purchased in FY2003.* Completed only for ASL data.

9. *Demonstrate the Access databases and reporting capabilities to users*. Objective fulfilled, with demonstrations of the salmon DBMS conducted for Anchorage users in August and Nome users in November.
10. *Distribute CDs with Access databases to researchers*. ASL data have been distributed upon request.

RECOMMENDATIONS

We recommend adoption of the scope of work (Brannian et al. 2004) for the AYK salmon DBMS by the Norton Sound Salmon Research and Restoration fund. This would dictate the following changes to the Norton Sound project component beginning in 2005. They are as follows:

- Realign the timeline and deliverables of project 05-11 Norton Sound Salmon Information Database to more closely match project FIS 04-701, especially the date of full web accessibility with a better understanding of the time it will take to develop data entry, editing, querying, and downloading capabilities for the SQL database (i.e. the final centralized database and salmon DBMS) through an Internet site.
- Acknowledge that development of metadata and maintenance of the project listing database are ongoing tasks of the AYK salmon DBMS and as such should not be considered complete until the end of the 5 year project (June 30, 2007). Metadata and the project listing database should be updated annually and be enhanced in response to user comments.
- Delete the following objectives for the period from July 1, 2004 to June 30, 2005 (Table 5):
    - Objective 3. *A usage code indicating the appropriate use of escapement data will be added to the database, i.e. index, estimate, presence/absence. Indicators of presence or absence of each species of salmon for each waterway will be added if needed*. After discussions with users and project biologists we have concluded that this usage code is not needed at this time. During its original conception on the statewide level biologists could not agree upon a common designation or application. This item should never have been elevated to the importance of an objective as it is merely an issue of database structure development and maintenance.
    - Objective 4. *Integrate the State of Alaska Watershed and Stream Hydrography Enhanced Dataset (AWSHED) Project developed by BLM and USGS. This watershed-based map system includes watershed definitions, water flow and standard water body identifiers.* Much of the data necessary pertaining to Norton Sound and AYK in general is not yet available (finalized) from this project (see http://agdc.usgs.gov/hydro/). We also note that this endeavor along with the next objective would represent a duplication of effort with the "Fish Distribution Database" as currently maintained by the Division of Sport Fish, ADF&G. Our scope of work mentions linkage with Sport Fish maintained data and a better approach would be to share GIS capabilities rather than create our own for AYK.
    - Objective 5. *Develop GIS component with map-based queries and reporting capabilities.* The AYK salmon DBMS is not yet developed enough to add a GIS component. As noted above, this objective is out of step with other components

described in our scope of work and duplicative with the Division of Sport Fish. Linkage with the Division of Sport Fish should be investigated though it would represent a "new" project and as such would need to be delayed until after 2006.

- Modify or delete the following objectives for the duration of the project (Table 5):
    - Objective 7 (July 1, 2004) *Begin incorporating additional datasets*. Modify this objective to read: Incorporate Norton Sound test fish data through the current year into the AYK salmon DBMS.
    - Objective 1 and 4 (July 1, 2005), Objective 1 (July 1, 2006) Aggregate, *standardize, and incorporate other data sets requested by users*. Per our scope of work additional datasets to incorporate into the AYK salmon DBMS are subsistence and commercial harvest data for Norton Sound.

The above changes will represent objectives that are achievable and assist reaching the goal of an AYK salmon DMBS. We propose a new set of objectives for the duration of the project (Appendix B).

ACKNOWLEGEMENTS

The National Oceanic and Atmospheric Administration under Cooperative Agreement NA16FW1272 funding for Research and Prevention Relative to the 1999 Norton Sound Fishery Disaster provided $44,600 in funding support for this project (04-11 *Norton Sound Salmon Information Database*). We thank Carlos Monsivais for checking escapement data, scanning data sheets, and keying data, and Amanda Orzechowski for error checking and keying biological data. We thank John Hilsinger, Susan McNeil, Hamachan Hamazaki, 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, 1G RAM, two 73GB hard drives in a RAID 1 configuration, running Windows 2000 Server

Software

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

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

Web server

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

Database server

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

Software

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

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

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Table 2.–Page 2 of 3.

Norton Sound Salmon Research and Restoration Project:	**USFWS Office of Subsistence Management Project:**
Norton Sound Salmon Information Database	FIS 04-701 Develop Shared Fishery Database
July 1, 2004–June 30, 2005: 1. Develop integrated SQL Server database with Internet data entry, editing, querying, reporting and downloading capabilities. 2. Populate server database. 3. A usage code indicating the appropriate use of escapement data will be added to the database, i.e. index, estimate, presence or absence. Indicators of presence or absence of each species of salmon for each waterway will be added if needed. 4. Integrate the State of Alaska Watershed and Stream Hydrography Enhanced Dataset (AWSHED) Project developed by BLM and USGS. This watershed-based map system includes watershed definitions, water flow and standard water body identifiers. 5. Develop GIS component with map-based queries and reporting capabilities 6. Demonstrate system to users. 7. Begin incorporated additional datasets.	***January 1–December 31 2005:*** 1. Present intermediate database systems (reports, editing, and data entry capabilities), preliminary metadata structure, and project database to users and collect comments. 2. Enter aerial survey data for the years that were not available in electronic form through 2004, into intermediate databases created in 2004 (Objective 3). 3. Standardize and error check escapement count data residing in intermediate databases created in 2004 (Objective 2); enter 2004 escapement count data. 4. Standardize and error check aerial survey data residing in intermediate databases created in 2004. 5. Standardize and error check ASL data residing in intermediate databases created in 2004; enter 2004 ASL data. 6. Develop integrated central database with preliminary data entry, editing, querying, reporting and downloading capabilities for escapement count, aerial survey, and ASL data incorporating comments. 7. Populate central database with data from intermediate escapement count, aerial, survey, and ASL databases. 8. Update metadata to account for additions to the database management system in 2005 and user comments. 9. Update intermediate project database.

-continued-

Table 2.–Page 3 of 3.

Norton Sound Salmon Research and Restoration Project:	**USFWS Office of Subsistence Management Project:**
Norton Sound Salmon Information Database	FIS 04-701 Develop Shared Fishery Database
July 1, 2005–June 30, 2006: 1. Continue incorporating datasets requested by technical/steering committees and users. 2. Deploy web-based GIS database. 3. Meet with users to demonstrate and critique system. 4. Continue to aggregate, standardized and incorporate other data sets requested by users. 5. Continued maintenance and improvement of user interface, reports, etc.	***January 1–December 31 2006:*** 1. Present central database system (preliminary queries, reports, editing, and data entry capabilities), updated metadata, and updated intermediate project database to users and collect comments. 2. Enter escapement count, aerial survey, and ASL data from 2005 into the central database. 3. Enhance data entry, editing, querying, and reporting components of the central database of the AYK salmon database management system and respond to comments collected through Objective 1 in 2006. 4. Transfer data from the intermediate project database (2005 Objective 9) to the central AYK salmon database. 5. Develop web access to central database for AYK salmon. 6. Provide web accessibility to the central database system (data entry, queries, reports, and down loads through the web) to users and collect comments.
July 1, 2006–June 30, 2007: 1. Aggregate, standardized and incorporate other data sets as requested by users. 2. Continued maintenance and improvement of user interface, reports, etc. 3. Modify and/or add data entry, editing, queries and reports based on users' evaluation.	***January 1–June 30, 2007:*** 1. Enhance web accessibility to the central database system (i.e., queries, reports, editing, and data entry capabilities) in response to user comments from 2006. 2. Enter escapement count, aerial survey, and ASL data from 2006 into the central database through the web. 3. Provide access to the AYK database management system web site to ADF&G users for testing. 4. Finalize metadata. 5. Provide public access to the web site for the AYK database management system, June 30, 2007.

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
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.
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.
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.
Chris Lawn is a recently hired AP II scheduled to begin work on the AYK salmon database management system December 27, 2004. Chris is a recent graduate of UAA with a degree in Management Information Systems. Chris is funded by NSSRR, project FIS 04-701, and SOA general funds. Under direction from Seth Darr, Chris will help develop and maintain the SQL central database and provide web accessibility.
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.

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								
Area	***Species***	***Years***	***Estimated Total Number of Files***	***Files In Database***	***Files To Be Added***	***Missing Files***	***% of Found ASL Files Loaded Into Database***	***% of Estimated Total That Has Been Found***
Kuskokwim	Chinook	1964-2004	266	240	4	22	98.4%	91.7%
	Chum	1964-1999	243	215	5	23	97.7%	90.5%
	Coho	1961-2001	147	135	1	11	99.3%	92.5%
	Sockeye	1964-1999	178	159	4	15	97.5%	91.6%
	Pink	1968-1994	11	2	0	9	100.0%	18.2%
		Total Files	***845***	***751***	***14***	***80***	**98.2%**	**90.5%**
Yukon	Chinook	1960-2003	957	776	43	138	94.7%	85.6%
	Chum	1961-2003	959	652	19	288	97.2%	70.0%
	Coho	1964-2003	175	116	8	51	93.5%	70.9%
	Sockeye	1979-1998	13	8	3	2	72.7%	84.6%
	Pink	1970	1	0	1	0	0.0%	100.0%
		Total Files	***2105***	***1552***	***74***	***479***	**95.4%**	**77.2%**
Norton Sound	Chinook	1966-2003	103	83	1	19	98.8%	81.6%
	Chum	1962-2003	193	164	0	29	100.0%	85.0%
	Coho	1963-2003	80	76	0	4	100.0%	95.0%
	Sockeye	1963-2003	9	8	0	1	100.0%	88.9%
	Pink	1965-1979	10	0	0	10	-	0.0%
		Total Files	***395***	***331***	***1***	***63***	**99.7%**	**84.1%**
Port Clarence	Chinook	1966-2003	3	2	0	1	100.0%	66.7%
	Chum	1962-2003	2	2	0	0	100.0%	100.0%
	Coho	2003	1	1	0	0	100.0%	100.0%
	Sockeye	1963-2003	5	5	0	0	100.0%	100.0%
	Pink	-	0	0	0	0	-	-
		Total Files	***11***	***10***	***0***	***1***	**100.0%**	**90.9%**
Kotzebue	Chinook	1978-1987	5	4	0	1	100.0%	80.0%
	Chum	1962-2003	179	133	13	33	91.1%	81.6%
	Coho	1984-1988	4	1	0	3	100.0%	25.0%
	Sockeye	1984-1989	4	3	0	1	100.0%	75.0%
	Pink	1978-1979	2	1	0	1	100.0%	50.0%
		Total Files	***194***	***142***	***13***	***39***	**91.6%**	**79.9%**
	Total ASL Files		**3,550**	**2,786**	**102**	**662**	**96.5%**	**81.4%**

Table 5.–Escapement data error checking summary for the Access version of SASPOP.

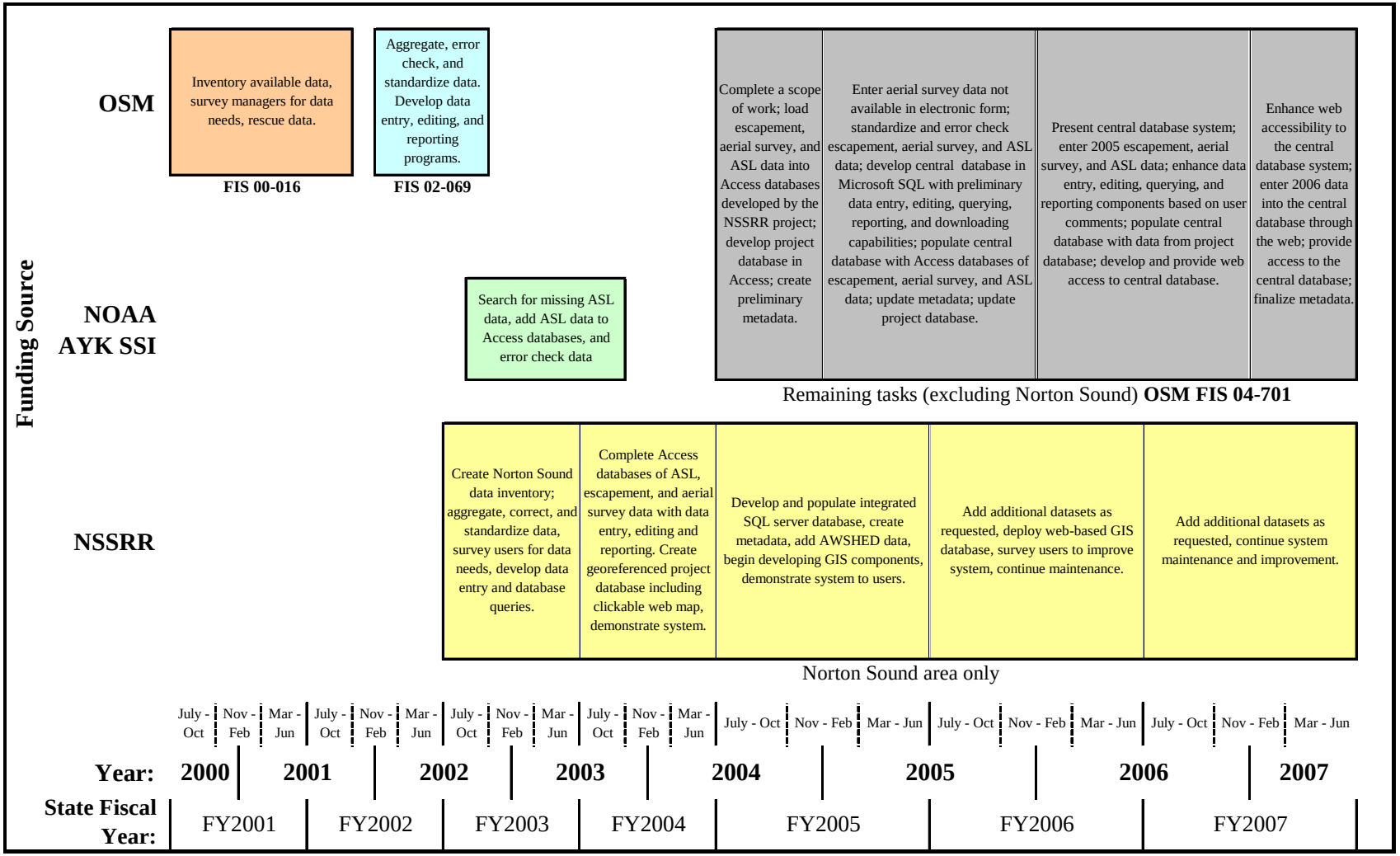
Region	Project	Years Operated	Species Counted					Number of Datasets Located[a]		
			Chinook	Chum	Sockeye	Coho	Pink	Spread sheets	Escapement Reports[b]	Discrepancies[c]
Kuskokwim	Kogrukluk Tower	1969-70, 72-78	x	x	x	x		28	28	0
	Middle Fork Goodnews Tower	1981-1990	x	x	x	x	x	47	47	1
	Kanektok Tower	1996-97		species were pooled				6	3	0
	Kwehtluk Tower	1996-97	x	x	x	x	x	9	0	n/a
	Takona Tower	1995-98	x	x				7	0	n/a
	Kogrukluk Weir	1976-1997	x	x	x	x		81	55	9
	South Fork Salmon River Weir	1981-82	x					2	0	n/a
	Middle Fork Goodnews Weir	1991-98	x	x	x	x	x	40	10	0
	George Weir	1996-97	x	x	x	x	x	10	0	n/a
	Kwehtluk Weir	1992	x	x	x	x	x	5	0	n/a
	Tulusak Weir	1991-94	x	x	x	x	x	20	15	1
	Tatlawisksuk Weir	1998	x	x				2	0	n/a
	Aniak Sonar	1980-94, 96-98		x				18	14	0
	Kanektok Sonar	1982-87	x	x	x	x	x	19	19	2
	Kuskokwim Sonar	1993-95	x	x	x	x	x	15	10	0
	Area Total							**309**	**201**	**13**
Yukon	Pilot Station Sonar	1986-97	x	x				24	4	4
	East Fork Andreasfsky Sonar	1981-85		species were pooled				5	5	4
	Anvik Sonar	1979-97		x				19	19	4
	Melozitna Sonar	1981-83		x				3	0	n/a
	East Fork Andreasfsky Weir	1994-98	x	x	x	x	x	22	14	14
	Giasa Weir	1994-97	x	x	x		x	13	8	1
	South Fork Koyukuk Weir	1996-97	x	x				4	4	2
	Beaver Weir	1996-97	x	x				4	2	1
	East Fork Andreafsky Tower	1986-88	x	x			x	9	6	2
	Anvik Tower	1972-76	x	x			x	15	10	5
	Kaltag Tower	1994-97	x	x				8	5	0
	Nulato Tower	1994-97	x	x				8	8	4
	Clear Tower	1995-97		x				3	3	0
	Chena Tower	1993-97	x	x				10	10	7
	Salcha Tower	1993-97	x	x				10	10	7
	Area Total							**157**	**108**	**55**
Norton Sound/Kotzebue	Kwiniuk Tower	1965-98	x	x		x	x	98	98	17
	North River Tower	1972-74, 84-98	x	x		x	x	31	31	2
	Niukluk Tower	1979, 95-98	x	x		x	x	18	18	0
	Eldorado Tower	1995-98	x	x		x	x	16	12	0
	Nome Tower	1993-95	x	x		x	x	12	12	5
	Snake Tower	1995-98	x	x		x	x	14	12	0
	Shaktoolik Tower	1996-98	x	x		x	x	12	12	2
	Pilgrim Tower	1997	x	x		x	x	4	4	1
	Noatak Sonar	1981-83, 91-94		x			x	12	12	1
	Nome Weir	1996-98	x	x		x	x	12	12	0
	Area Total							**229**	**223**	**28**
	Region Total							**695**	**532**	**96**

[a] A dataset was defined as salmon counts for one species/year/project.

[b] Escapement reports are stored in hard copy format in the Anchorage Fish and Game office.

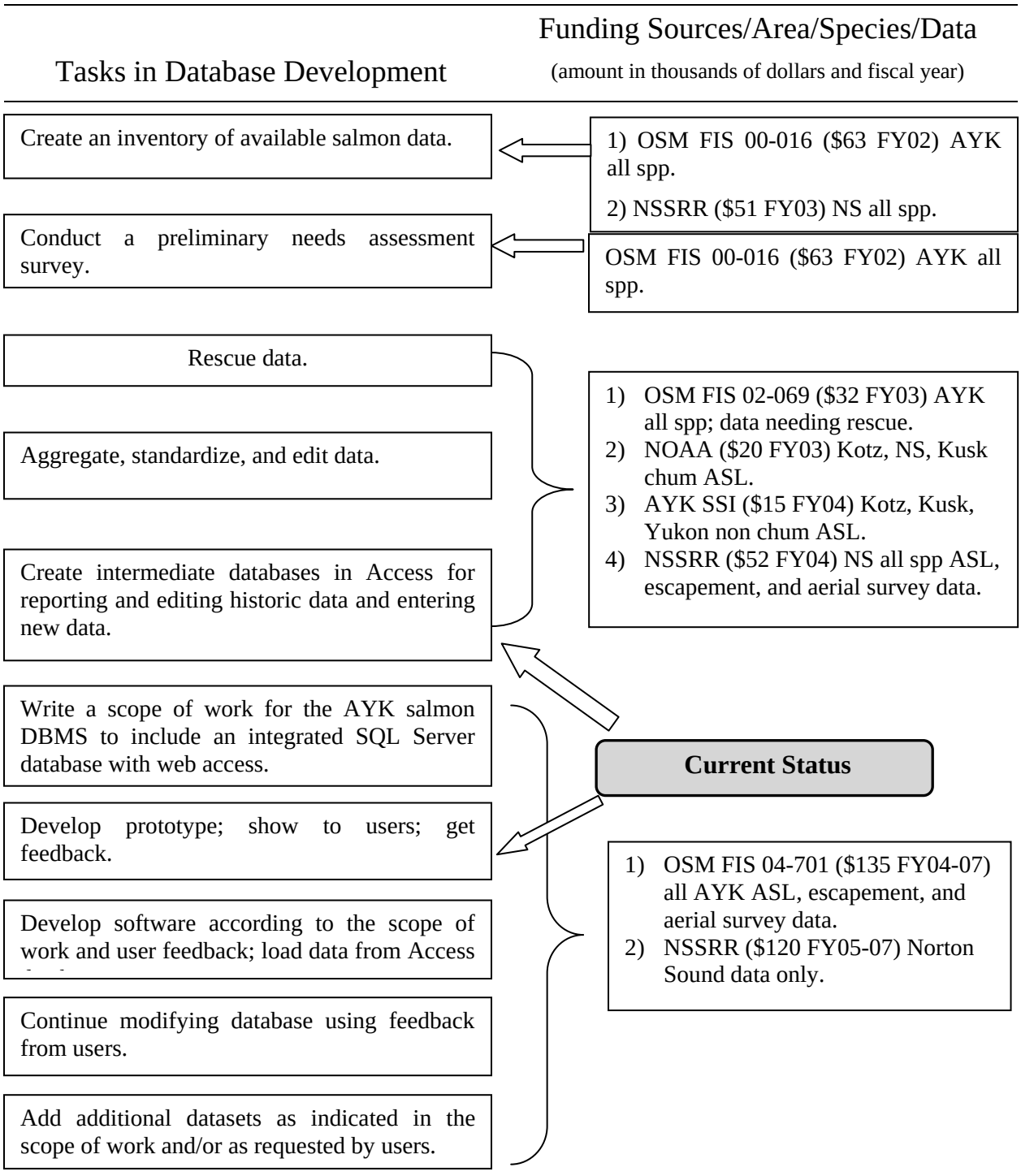
[c] Salmon escapement counts from the spreadsheet were compared to the counts in the escapement reports.

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.

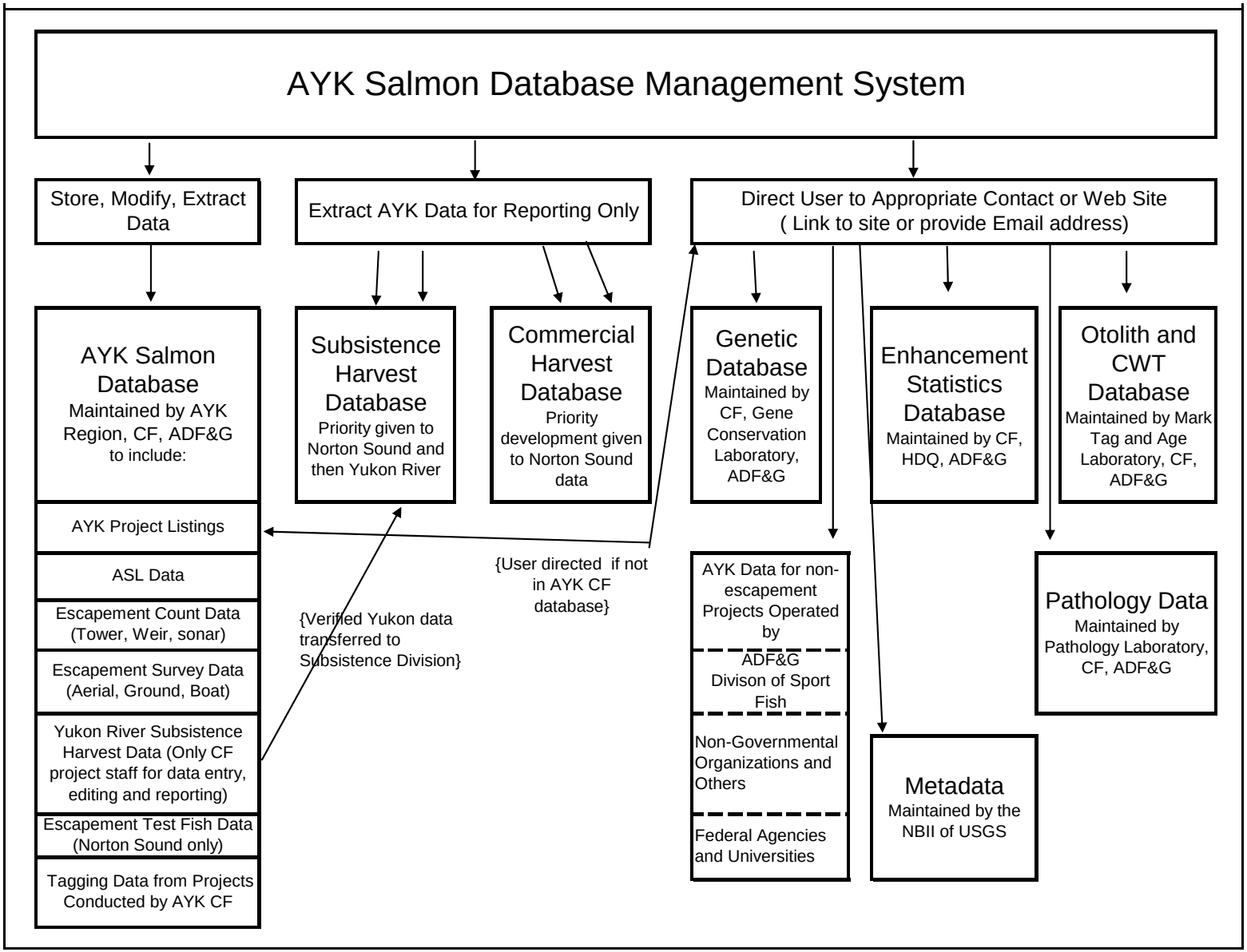


Figure 4.–Components of the AYK salmon database management system.

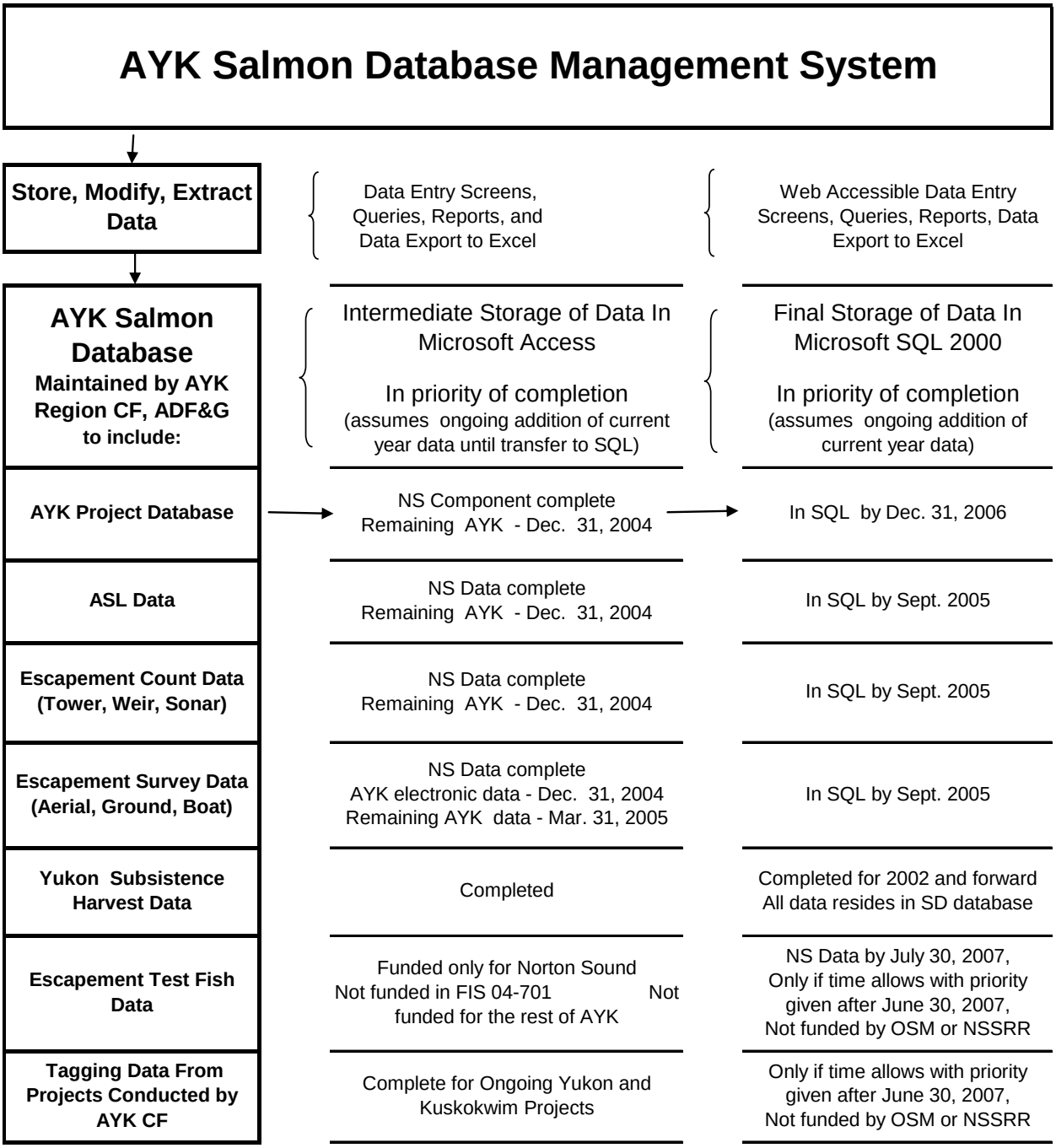


Figure 5.–Priority and timeline for database components maintained by the Division of Commercial Fisheries AYK Region, September 2004.

Current Norton Sound Escapement Projects

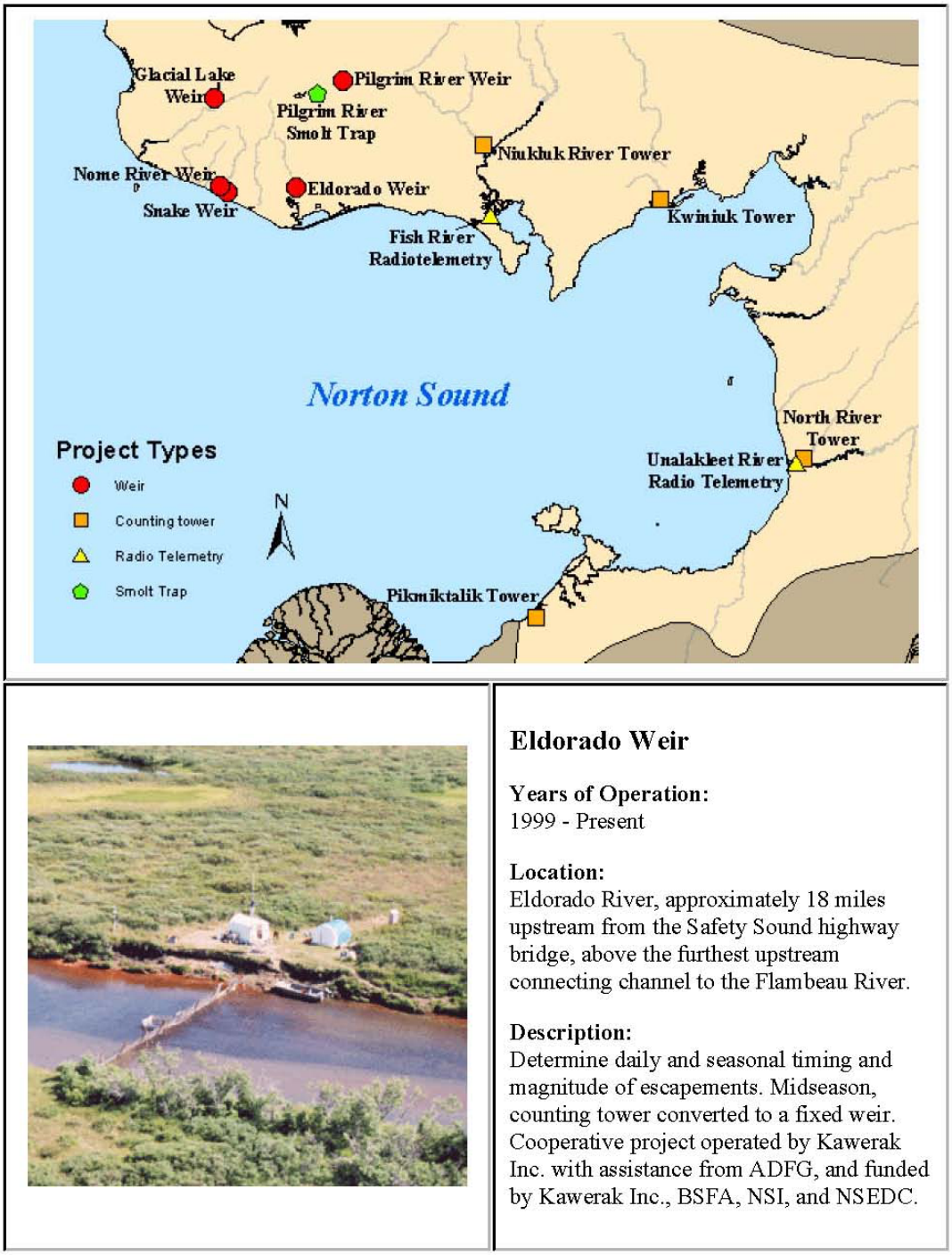


Figure 6.–Illustration of the Norton Sound map of projects (web accessible) and an example of project information.

APPENDIX A

Appendix A.–Example of project listings in AYK salmon database management system.

Project Summary

Stream	Site	current	Year(s)	Contact	Agency	Division
Area M						
	Area M Mark/Recapture	☐	1960, 1987	Jim Menard	ADFG	CF
	Tagged salmon were caught from the Area M release in 1960 and 1987 by ADF&G.					
Boston Creek						
	Boston Creek Carcass Sample	☐	1978	Jim Menard	ADFG	CM
	The ADF&G Commerical Fisheries division collected carcass samples at Boston Creek in 1978.					
Chirosky River						
	Chirosky River Tower	☐	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						
	Eldorado Tower	☐	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, Sitnasuak 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
	Eldorado Weir	☑	1999 - Present	Timothy Kroeker	ADFG, KC	CF
	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.					
Fish River						
	Fish River Radiotelemetry	☑	2003 - Present	Gary Todd	ADFG	CF
	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.					
Glacial Lake						
	Glacial Lake Weir	☑	1979, 2000 - Present	Dave Parker	BLM	NONE
	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.					

APPENDIX B

Appendix B.–Proposed annual objectives and deliverables for the Norton Sound Salmon Information Database project in response to completion of the scope of work for the AYK salmon DMBS (Brannian et al. 2004).

January 1, 2005–June 30, 2005 (05-11)

1. Presentation of intermediate database systems (queries, reports, editing, and data entry capabilities), preliminary metadata structure, and project database to users and collect comments; February 15, 2005.
2. Complete IT review of project listing database, prepare reports which present all available data, send to project biologists for review; March 15, 2005.
3. Enter escapement count, aerial survey, and ASL data from 2004 into the intermediate Access database and corrections from previous IT review; March 31, 2005.
4. Incorporate Norton Sound test fish data through the current year into intermediate database; June 30, 2005.
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 (see 06-11).

{All objectives except number 4 above are in common with USFWS OSM Project 04-701 and will be accomplished for all AYK data. Project 05-11, lasting through June 30, 2005, will pay 4 months of Analyst Programmer and Research Analyst salaries beginning January 1, 2005}

July 1, 2005–June 30, 2006 (06-11)

1. Development of integrated central database with preliminary data entry, editing, querying, reporting and downloading capabilities incorporating comments from February 2005 presentation; August 31, 2005.
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; December 31, 2005.
4. Update of intermediate project database to account for additions to the database management system in 2005 and project biologist review comments; December 31, 2005.
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; February 15, 2006.
6. Entering of escapement count, aerial survey, and ASL data from 2005 into the central database; March 31, 2006.
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).

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{All objectives above are in common with USFWS OSM Project 04-701 and will be accomplished for all AYK data. Project 06-11 funding (FY06) for this 12 month period will pay 5 months of Analyst Programmer salary and 3 months of Research Analyst salary. Presentations will occur in Anchorage and Nome}

July 1, 2006–June 30, 2007 (07-11)

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; August 31, 2006.
2. Development of data extraction and reporting for Norton Sound subsistence and commercial harvest data; December 31, 2006.
3. Transferring of data from the intermediate project database (currently in Access) to the central AYK salmon database; December 31, 2006.
4. Development of web access to central database for AYK salmon; December 31, 2006.
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; December 31, 2006.
6. Enhancement of web accessibility to the central database system (queries, reports, editing, and data entry capabilities); respond to user comments from 2006; March 31, 2007.
7. Entering of escapement count, aerial survey, and ASL data from 2006 into the central database through the web; March 31, 2007.
8. Provide access to the AYK database management system web site to ADF&G users for testing; March 31, 2007.
9. Finalize metadata; March 31, 2007.
10. Provide public access to the web site for the AYK database management system; June 30, 2007.

{All objectives except number 2 above are in common with USFWS OSM Project 04-701 and will be accomplished for all AYK data. Project 07-11 funding (FY07) available for this 12 month period will pay 5 months of Analyst programmer salary and 2 month of Research Analyst salary}