

**Special Publication No. 06-21**

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# **Development of the Arctic-Yukon-Kuskokwim Salmon Database Management System through June 30, 2006**

**Annual Report for Project 06-11, *Norton Sound Salmon Information Database*,  
Norton Sound Salmon Research and Restoration Program and  
Project FIS 04-701, *Develop Shared Fishery Database*,  
USFWS Office of Subsistence Management, Fisheries Information Services Division**

by

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July 2006

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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.

<b>Weights and measures (metric)</b>		<b>General</b>		<b>Measures (fisheries)</b>	
centimeter	cm	Alaska Administrative		fork length	FL
deciliter	dL	Code	AAC	mid-eye-to-fork	MEF
gram	g	all commonly accepted		mid-eye-to-tail-fork	METF
hectare	ha	abbreviations	e.g., Mr., Mrs., AM, PM, etc.	standard length	SL
kilogram	kg			total length	TL
kilometer	km	all commonly accepted			
liter	L	professional titles	e.g., Dr., Ph.D., R.N., etc.		
meter	m	at	@	<b>Mathematics, statistics</b>	
milliliter	mL	compass directions:		<i>all standard mathematical</i>	
millimeter	mm	east	E	<i>signs, symbols and</i>	
		north	N	<i>abbreviations</i>	
		south	S	alternate hypothesis	H <sub>A</sub>
		west	W	base of natural logarithm	<i>e</i>
		copyright	©	catch per unit effort	CPUE
		corporate suffixes:		coefficient of variation	CV
		Company	Co.	common test statistics	(F, t, $\chi^2$ , etc.)
		Corporation	Corp.	confidence interval	CI
		Incorporated	Inc.	correlation coefficient	
		Limited	Ltd.	(multiple)	R
		District of Columbia	D.C.	correlation coefficient	
		et alii (and others)	et al.	(simple)	r
		et cetera (and so forth)	etc.	covariance	cov
		exempli gratia	e.g.	degree (angular)	°
		(for example)		degrees of freedom	df
		Federal Information	FIC	expected value	<i>E</i>
		Code		greater than	>
		id est (that is)	i.e.	greater than or equal to	≥
		latitude or longitude	lat. or long.	harvest per unit effort	HPUE
		monetary symbols		less than	<
		(U.S.)	\$, ¢	less than or equal to	≤
		months (tables and		logarithm (natural)	ln
		figures): first three		logarithm (base 10)	log
		letters	Jan, ..., Dec	logarithm (specify base)	log <sub>2</sub> , etc.
		registered trademark	®	minute (angular)	'
		trademark	™	not significant	NS
		United States		null hypothesis	H <sub>0</sub>
		(adjective)	U.S.	percent	%
		United States of		probability	P
		America (noun)	USA	probability of a type I error	
		U.S.C.	United States	(rejection of the null	
			Code	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

### Weights and measures (English)

cubic feet per second	ft <sup>3</sup> /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	pH
(negative log of)	
parts per million	ppm
parts per thousand	ppt, ‰
volts	V
watts	W

***SPECIAL PUBLICATION NO. 06-21***

**DEVELOPMENT OF THE ARCTIC-YUKON-KUSKOKWIM SALMON  
DATABASE MANAGEMENT SYSTEM THROUGH JUNE 30, 2006**

by

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## ABSTRACT

The Alaska Department of Fish and Game (ADF&G), Division of Commercial Fisheries, Arctic-Yukon-Kuskokwim (AYK) Region is creating a salmon database management system (DBMS). The goal of the database is to provide managers, researchers, and the public involved in salmon fisheries in the AYK Region with a system to enter and process new data, as well as to retrieve historical data. By June 30, 2007 the AYK salmon DBMS will allow users to store, modify, and extract AYK project listing data, biological measurements of age, sex, and length (ASL), escapement data, and Norton Sound test fisheries data through an Internet site. Extraction and reporting through the Internet of subsistence and commercial harvest data will also be completed for Norton Sound by June 30, 2007. This report represents an annual report for two projects providing funding support. It is the fourth year of funding from the Fishery Disaster Relief Program for Norton Sound (NOAA NA16FW1272) which supports Norton Sound components of the AYK salmon DBMS and the second year of funding from the United States Fish and Wildlife Service, Office of Subsistence Management for project FIS 04-701. During this reporting period (July 1, 2005 through June 30, 2006) the design of the central database was finalized and data were loaded from intermediate databases through 2005. Standardization and review was completed for database components involving aerial survey, escapement count, Norton Sound test fish, and ASL data. The project listing database was integrated into the central database, and metadata records were completed for each management area, species and dataset. Data have been distributed to researchers upon request. Finally, computers purchased for this project were configured as servers, brought on line behind the state firewall as "intranet" servers for testing, and finally integrated into ADF&G's network.

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 it imperative all parties have access to the same information. Funds were provided by the U. S. Fish and Wildlife Service (USFWS) Office of Subsistence Management (OSM), the Alaska Department of Fish and Game (ADF&G) general funds and other federal grants, specifically the Norton Sound Salmon Research and Restoration fund (NSSRR), for the Arctic-Yukon-Kuskokwim (AYK) Region of ADF&G to create a database management system in which all data will be centralized, have a standard format, and be shared among management agencies and the general public.

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

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

to answer. In addition, the dangers of losing data during staff turnover and degradation in electronic media are a concern.

## **BACKGROUND AND FUNDING SOURCES**

Recognizing the need to develop a mechanism to standardize the collection, storage, and analysis of fisheries information in January 2000 (Figure 2), ADF&G AYK staff proposed a 5 year project to create a salmon database management system for AYK to USFWS OSM. This proposal was rejected because of its cost and duration, and instead a 1 year \$60,000 pilot project (FIS 00-016) was funded. The specific objectives of project FIS 00-016 were to (1) create an inventory of existing salmon data sources, and (2) to conduct a preliminary needs assessment survey of fisheries managers and researchers in the AYK Region. As part of this effort, historical and current AYK salmon projects were described and primary contact information (agency, project leader, etc.) was included (Hamner et al. 2002). An inventory of project associated data was created to include electronic filename, file type, project type, location, species, and data descriptions. As part of the project, a summary of the results of an informal survey of State and Federal fisheries management and research staff was included. This summary identified data sets and data summaries required to make more informed fishery management decisions. The 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 (referred to as the NSSRR), 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, 2005a; 2005b).

The Steering Committee for the NSSRR fund approved a 5 year project (from July 1, 2002 to June 30, 2007)<sup>1</sup> for the development of a Norton Sound Salmon Information Database (Hamner et al. 2003b). In the first year of the project, a data inventory was updated (see overlap with FIS 00-016 in Figures 2 and 3) and completed for the Norton Sound area. Additional age, sex, and length (ASL) electronic files for Norton Sound salmon were aggregated and transferred to modern storage media. In the second (Brannian et al. 2005a) and third (Brannian et al. 2005b) years, Access databases were populated with Norton Sound and Kotzebue data through 2004 representing ASL measurement data, escapement count data (weirs, towers, sonar), escapement survey data (aerial, foot, or boat), and test fish data. Although these funds are allocated specifically for Norton Sound, applications and database structures developed for the Norton Sound area will be used for other areas of the region since data collection follows a standard protocol across the region. A single database is being developed.

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<sup>1</sup> Funding is approved each year based on fulfillment of annual project objectives.

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

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

## **GOAL AND OBJECTIVES FOR THE AYK SALMON DATABASE MANAGEMENT SYSTEM**

The AYK salmon database management system (DBMS) is currently supported by two projects. The Norton Sound Salmon Research and Restoration fund supports Project 06-11, *Norton Sound Information Database*, and the USFWS OSM approved funding for project FIS 04-701, *Develop Shared Fishery Database*. 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, 2005 to June 30, 2006. These objectives represent project 06-11, *Norton Sound Information Database* as described by Brannian et al. (2005a) and include:

1. Development of an integrated central database with preliminary data entry, editing, querying, reporting and downloading capabilities.

2. Population of the central database with escapement count, escapement survey, Norton Sound test fish, and ASL data from intermediate databases.
3. Update of metadata to account for additions to the database management system in 2005 and user comments.
4. Update of intermediate project database to account for additions to the database management system in 2005 and project biologist review comments.
5. Presentation of central database system (preliminary queries, reports, editing, and data entry capabilities), updated metadata, and updated intermediate project database to users and collect comments.
6. Entering of escapement count, aerial survey, test fish, and ASL data from 2005 into the central database.
7. Enhancement of data entry, editing, querying, and reporting components of the central database of the AYK salmon database management system and response to comments collected through Objective 5 above.

Specific objectives were funded by USFWS OSM for completion during the period from July 1, 2005 to June 30, 2006. These objectives represent the second year of project FIS 04-701, *Develop Shared Fishery Database* and include:

1. Standardize and error check aerial survey data residing in intermediate databases created in 2004.
2. Standardize and error check ASL data residing in intermediate databases created in 2004; enter 2004 ASL data.
3. Develop integrated central database with preliminary data entry, editing, querying, reporting, and downloading capabilities for escapement count, aerial survey, and ASL data incorporating comments from the presentation in February of 2005.
4. Populate central database with data from intermediate escapement count, aerial, survey, and ASL databases.
5. Update metadata to account for additions to the database management system in 2005 and user comments.
6. Update intermediate project database to account for additions to the database management system in 2005, as well as user comments.
7. 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.
8. Entering of escapement count, aerial survey, test fish, and ASL data from 2005 into the central database.
9. 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 7 above.

## **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. Qualified users will be able to store current year data, modify historic data, and extract data for analysis and reporting. Not all users will have permission to store and modify data though all users will be able to extract and report non-confidential data<sup>2</sup>. 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 (as collected by the Division of Subsistence (SD)) 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 with a link to the appropriate web site or a contact email name and or address if interested in data collected by ADF&G and referenced in the AYK project listing database. 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 (Figure 5) is being loaded in three stages: (1) data initially entered by staff into standalone databases created in Microsoft Access<sup>3</sup>; (2) these data are then loaded into intermediate SQL Server databases where the data are further error checked and validated; and (3) these data are moved to the one final SQL Server central database (Figure 6). Rudimentary data entry screens, editing, and reporting applications have been developed in Access. This intermediate step was necessary because staff that started this project are knowledgeable in Access and it possessed features useful to the intermediate process of data aggregation and standardization. Each data set can reside in its own standalone Access database and can be run

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<sup>2</sup> Examples of confidential data are an individual's commercial or subsistence harvest.

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

from personal computers not necessarily connected by the Internet. The intermediate Access databases have been 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.

The current system of standalone Access and intermediate SQL databases are temporary solutions. By project completion in June 2007, all data will be housed in the one final SQL Server central database (Figure 7). This database will be accessed via web application through a browser, or a Windows application on the user's computer. To address the need for data access when Internet access is unavailable, the Windows applications will use a local XML cache. This XML cache is essentially a set of text files that are downloaded from the central database and are used by the application in the same manner as a database system. When Internet access becomes unavailable, the application allows the user to view and edit data against the XML cache. At the point of time that Internet access becomes available again, the Windows application uploads the data back to the central SQL Server.

In order to ensure that only one user edits a particular set of data at a time, a check-in/check-out system is used. When a particular user has permission to edit a set of data, the user can check these data out from the central database. The check-out process initiates a download of XML data to the user's machine for viewing and editing. The data set that is checked out will have to be checked back in to make that dataset available to other users. The same process will be used when accessing data from the web application, although in this scenario, the XML data are not downloaded to the user's computer but is instead created on the web server itself. This allows the user of the web application to edit data and then safely cancel his edits without corrupting the central database.

## **COMPUTER HARDWARE REQUIREMENTS**

In 2003, a server (Table 1) was purchased with funding from the NSSRR to act as the AYK salmon database and Intranet server. Two additional servers (see Table 1 for exact specifications) were purchased in 2005 with funds from project FIS 04-704, one database server and one web server. Once all servers are operational the server purchased under NSSRR will be freed to serve in three possible ways: as purely an Intranet server, as a replicated database server, and as a testing server. All servers are backed up nightly using existing equipment within the network services department.

## **COMPUTER SOFTWARE REQUIREMENTS**

Under NSSRR, much of the core software has been purchased for the development of the AYK salmon DBMS (Table 1). Microsoft Visual Studio .NET Professional 2003 is an Integrated Development Environment (IDE) that allows programmers to develop native Windows and web applications that run on the .NET framework. All future interface development (barring Access work) will be done in Visual Studio .NET. Microsoft Visual Studio .NET Professional 2003 was purchased, and we are now in the process of purchasing Microsoft Visual Studio .NET Professional 2005. Microsoft SQL Server 2000 with 5 CAL (Client Access Licenses) was purchased and serves as the database software used to house the central repository of data. In the future, more licenses for SQL will need to be purchased if the volume of use increases greatly, but the current purchase should reasonably serve AYK needs in the near future. AYK Region's Microsoft Access was upgraded to the 2003 version. CA Brightstor ArcServe 2000 Backup Agent software was purchased to integrate database backup with the existing network backup

infrastructure. Spatial Metadata Management System (SMMS) Version 5.1 software was 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), clients will not have to install updates to their systems. 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.

Development of Internet accessibility for this project can be described in terms of three major components: Standalone Access databases, Intermediate SQL databases, and a Final SQL database with Windows/Web access. The Standalone Access databases are the most developed and are essentially intermediate databases cleared of all data and used for inseason (ASL) and postseason (non-ASL) data collection, editing, and reporting by project leaders (or their designees). These databases reside on individual staff's computers (independent of Internet or WAN access) or on shared network drives. The Intermediate SQL databases are used as central collection points for data from standalone Access databases. Data are periodically loaded into these databases by IT staff, at which point error checking and error corrections are performed. Three Intermediate SQL databases currently house (1) AYK ASL data, (2) all survey and count escapement data, and (3) Norton Sound and Kotzebue test fish data. The final SQL database, of which a beta version exists, is the final repository for these corrected data, and in the final version of the system, the only repository for all AYK data. The Final SQL database will be accessible through either a web application written in ASP.NET or a Windows application written in VB .NET. This component will have a login system that will determine the level of

access to the data (public, agency, project staff, etc), as well as a check-in/check-out system to ensure proper coordination of data edits.

During development and testing of web and Windows applications, only ADF&G staff will be able to access test data within the State's network. The Standalone components have been used for ASL data collection by Emmonak and Norton Sound staff since June 2005. Since November 2005, Standalone components have been used by Norton Sound and Yukon staff to enter survey and escapement count data. Final testing of the web/windows components by AYK staff will begin February 2007. The web component in this phase will still be accessible only within the State's WAN. Only when staff are satisfied with all group and individual levels of access and functionality will the site be made public, this will need to occur by June 30, 2007.

## **AYK SALMON DATASETS**

An enormous quantity of historical salmon data exists for the AYK region. More than 150 projects to monitor salmon harvests, escapements, and measure stock abundance and biological attributes have been conducted in the region in the last 40 years (Hamner et al. 2002). Subsistence salmon harvest information has been collected throughout the AYK Region. Data from all commercial landings made in the region's salmon fisheries since 1969, consisting of over 9 million commercial sales receipts (fish tickets), are available in electronic format. Salmon observations have been made on more than 315 streams in the AYK Region and include over 70,000 records of daily and annual estimates of abundance before 1999. Biological information has been collected for over 40 years from harvests and escapements to estimate the ASL composition of these salmon populations.

### **AGE, SEX, AND LENGTH DATA**

Salmon ASL data are collected annually from sampled commercial and subsistence harvests, escapement, run timing and abundance monitoring projects in the AYK Region. Scales are collected primarily to determine the age of fish, but may also be examined for growth patterns. Since the distance between scale annuli represents the growth of a fish in 1 year, scales are a permanent record of annual growth over the lifetime of an individual salmon. Salmon length is generally represented by a measurement to the nearest 5 millimeters from mid-eye to tail fork. Sex of the salmon is determined from either external characteristics or internal inspection of reproductive organs.

Age, sex, and length data have been collected in the Yukon Area since 1960, in the Kuskokwim Area since 1961, and in the Norton Sound-Kotzebue Area since 1962. All salmon species have been sampled but the emphasis has been on chum and Chinook salmon. Scales collected from salmon are stored on gum cards along with an acetate impression used to determine age. Both are organized into files by year, species, and project and stored in cabinets located in the Anchorage ADF&G office. Paper copies of ASL data are filed in the same location. In most years, ASL data were converted to electronic data files located on either mainframe or personal computers. However, no formal archiving system was established and much of the electronic data have been lost.

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



corresponding electronic data files that could be found were aggregated on a file server (Hamner et al. 2003a). ASL data were then loaded into area-specific Access databases for Norton Sound, Yukon, or the Kuskokwim areas. When electronic files could not be found for certain project-years, paper data forms were scanned or hand keyed to recover data. Data inventory and recovery by this project has ended, but historic data when brought to us are added to the AYK salmon DBMS. All electronically available ASL data have been loaded. Paper forms representing about 163 files are left to be hand entered and represents Norton Sound chum, Kotzebue chum, Yukon River chum and coho salmon data for which electronic versions are not available.

## **ESCAPEMENT**

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

In 1996, NOAA Earth System Data and Information Management System Program (RFP 52ABNF600096) funded ADF&G to develop a database on the status of Alaska salmon populations (SASPOP). The goal was to develop a geo-referenced database, to include links to the Anadromous Waters Catalog (AWC)<sup>4</sup>, of salmon escapement data collected statewide between 1960 and 1998. The SASPOP database was initially developed for Southeast Alaska and the fields and structure were most suited to the types of data collected in that region. Later, it was modified to incorporate escapement data for the entire state. Consequently, many of the fields are not applicable to the AYK Region. Some portions of the project could not be completed because agreement was not reached on tasks such as creating a standard method of computing indices of escapement or a system of usage codes defining the appropriate use of the data. Lastly, this was a multiple year project and funding for it was not renewed after completion of the database for Southeast Alaska. Work to extend SASPOP to a statewide application ended before completion in 1999. The Oracle software version of SASPOP is no longer maintained or updated by ADF&G.

Many spreadsheets of daily passage counts from AYK were standardized for inclusion in the SASPOP database before project termination. Other data were keyed from paper copies of project reports into a spreadsheet template created for the SASPOP project. These data were imported into database client-server software (Oracle) and were also available in Access. The SASPOP project was terminated before all AYK data were edited, reformatted and incorporated

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<sup>4</sup> 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>

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.

Incorporating all escapement observations collected in AYK into the AYK salmon DBMS is important to meeting project goals and objectives. Furthermore, editing and verifying the accuracy of those data must occur. Both steps are time consuming and entail a thorough search for data. Currently the SQL database of AYK escapement data includes (1) escapement count data (tower, weirs, and sonar) previously in the SASPOP database, (2) early aerial survey and other escapement data retrieved from the Honeywell mainframe computer system, (3) escapement count data collected in AYK since creation of the SASPOP database (through 2005), and (4) aerial, ground, and boat survey data through 2005 for all of AYK. All data have been edited, errors noted, and corrections made to the database. Still to occur is a thorough review by knowledgeable staff to ensure that no escapement projects are missing from the database.

## **SUBSISTENCE HARVEST**

As of 2002, approximately 9,050 households annually harvest salmon for subsistence in AYK Region. In general households are surveyed post season to collect subsistence data. The first survey of subsistence harvests took place on the Yukon River in 1919; however, harvests were not reported by village until 1931. Systematic surveys have been conducted annually since 1960 in the Kuskokwim Area, 1961 in the Yukon Area, 1963 in the Norton Sound Area, and 1967 in the Kotzebue Area. Surveys during the early years only documented harvests of Chinook and small salmon (all other salmon species combined). Most surveys included the number of fishing families, and type of gear and number of dogs per household. An overview and comparison of the subsistence methods used in each area and the history of data collection were reviewed and summarized by the statewide subsistence harvest assessment working group (Caylor 2000) funded by project FIS 00-017.

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

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

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

Data collected since 2002 have been entered directly into a Microsoft SQL database component of the AYK salmon DBMS. This component is being used to develop Internet access. Though currently in use behind the State's firewall, ADF&G staff in Fairbanks enter and extract data from the database through the Internet.

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

## **COMMERCIAL HARVEST**

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

Though commercial harvest was identified as a data category during the initial inventory (Hamner et al. 2002), fish ticket data will continue to reside in the centralized database maintained by Computer Services Section in Juneau. Data dating back to 1985 will be extracted from that database by the AYK salmon DBMS for reporting. Architectural and consistency problems may necessitate that higher level catch summaries for years before 1985 reside in the

AYK salmon DBMS. This data category will be one of the last to be added and will initially be added only for the Norton Sound area as a deliverable for the NSSRR project. Commercial harvest data are currently collected, entered, stored, and reported in a standardized manner following policy developed by the Computer Services Section in consultation with fisheries managers throughout the Division of Commercial Fisheries.

## **TEST FISHERIES**

Fishery managers collect salmon abundance, distribution and run timing information from test fisheries. Standardized gear and fishing procedures are used by ADF&G employees or other cooperating groups. Explicit location, time of day (if less than continuous) and gear dimensions are used to capture salmon information. Data are expressed as catch per unit effort (CPUE). Test fisheries can monitor salmon migrations 24 hours per day, 7 days per week. Fish wheels, set gillnets and drift gillnets have been used in AYK. CPUE has been expressed for gillnets as number of salmon per 100 fathom hours fished. Test fisheries data currently reside in individual spreadsheets under the control of the project leader located in AYK area offices.

Only Norton Sound test fishery data currently resides in the AYK salmon DBMS (Brannian et al. 2005b). These data represent the test fish project operated in the mouth of the Unalakleet River since 1981. Other AYK test fisheries will be included, as time allows, though a higher priority will be placed on including these data after June 30, 2007.

## **TAGGING DATA**

Projects have been operated in AYK in which tags are placed on or in salmon to monitor migration pathways, spawning destinations, travel time, or are used in mark-recapture experiments to estimate abundance (Hamner et al. 2002). The data either resides in spreadsheets or published reports. Data from a radio telemetry project for Chinook salmon in the Yukon River and spaghetti tagging projects for chum, sockeye, and coho salmon in the Kuskokwim River and chum salmon on the Tanana River reside in project specific Access databases and Excel spreadsheets maintained by ADF&G CF staff. Brannian et al. (2004) indicated that funds have not been secured to add these data to the AYK salmon DBMS. They also recognized this data type as a future DBMS component. A number of tagging projects (spaghetti or radio telemetry) conducted by Federal agencies will be referenced in the project listing database and the AYK salmon DBMS user will be provided with contact information.

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

## **ENHANCEMENT DATA**

ADF&G oversees and regulates all salmon rehabilitation and enhancement projects conducted by the department or others. The permitting process for such projects requires the collection of data and approval by geneticists, pathologists, and biologists. Permit and production data are maintained by staff in the Division of Commercial Fisheries located at the headquarters office in Juneau. Few enhancement projects have occurred in AYK. Fertilizer was added to Salmon Lake (which drains through Pilgrim River into Norton Sound), incubation boxes for chum salmon

were placed in several rivers in the Norton Sound area (Hamner et al. 2003b), and chum salmon were raised at the Clear Creek Hatchery for release into the Yukon River drainage (Hamner et al. 2002). Data from these projects will not be stored in the AYK salmon DBMS. Project name, location, and other pertinent data will reside in the project listing database. Users of the AYK salmon DBMS interested in these data will be directed to the appropriate web site or contact address.

### **STOCK IDENTIFICATION DATA**

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

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

### **PATHOLOGY DATA**

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

### **PROJECT LISTING DATA**

The idea of a project listing database grew out of the initial inventory prepared by Hamner et al. (2002; 2003a). We thought it useful to have descriptive data for escapement count, escapement survey, test fishing, commercial and subsistence monitoring, age-sex-length sampling, mark-recapture, radio telemetry, tagging, enhancement, and other projects that have been conducted in AYK and are of interest to users of the AYK salmon DBMS. The database was initially created as a merging of the data inventory spreadsheet prepared by Hamner et al. (2002; 2003a) with a table within the escapement database listing all escapement projects. The database has since been expanded to include general escapement sampling and updated to include projects initiated since or not included in the original project inventory. The project listing database functions as a metadata repository for the AYK salmon DBMS.

The project database has evolved into a flexible and multi-tiered structure. Project name, project type, description, project years of operation, location, contact and participant information, staff

data, and associated data types are all stored in the database. True to the dynamic nature of fisheries management projects, projects can have different sites and combinations of participants for each year. Links from these descriptive data to raw data are included for data types housed in the DBMS. Data maintained externally (commercial harvests, subsistence, etc.) will be referenced by these project tables.

## **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 2005) and will be posted to their website when finalized. AYK staff have attended a workshop conducted by NBII and purchased their recommended software, SIMMS version 5.1. Metadata at interim grouping levels have been developed. Grouping levels may change and more detailed information may be included each year until metadata are finalized in June 2007. We will not post metadata on the NBII website until that data are actually available through the AYK salmon DBMS. Information gathered to meet NBII metadata requirements will also be added to the extent applicable in our centralized database possible associated with our project listing database.

## **PROGRESS IN DEVELOPMENT OF THE AYK SALMON DBMS JULY 1, 2005–JUNE 30, 2006**

During this reporting period we undertook tasks to fulfill objectives for the Norton Sound (Project 06-11) and the USFWS OSM (FIS 04-702) projects supporting completion of the AYK salmon DBMS. Tasks involved (1) final design of the SQL central database with script development to import data from intermediate databases, (2) population of the central database with data from intermediate escapement count, aerial survey, test fish, and ASL databases, (3) update of a database comprised of project description information, (4) completion of preliminary NBII compliant metadata, (5) standardize and error check aerial survey and ASL data currently in the DBMS, (6) presentations of the AYK salmon DBMS to users in Anchorage and Nome, and (7) adding escapement count, aerial survey, test fish, and ASL data from 2005. In addition, we set up servers (hardware) and extracted data in response to users' request.

### **CENTRAL DATABASE DEVELOPMENT AND DATA IMPORTATION**

During this reporting period the structure of the final central database was completed. All mappings between this database and the intermediate SQL databases were diagrammed. Scripts were then developed to import data from the intermediate SQL databases into the final central database. Scripts that import from standalone Access databases to the intermediate SQL databases were finalized and refined. In summary, we ended up developing a working migration path from Access to the intermediate SQL databases, and then to the final central SQL database (Figure 6).

Data from the intermediate SQL databases have been loaded into the final central database via the above mentioned scripts. The transformation is still considered draft until we further verify that (1) the scripts have successfully transferred all data completely and correctly, and (2) all so-called “mapping tables” have been populated completely and correctly. Mapping tables are tables within the final central SQL structure that are employed by the import process to accurately translate location, observer, and project codes in the various intermediate SQL databases to their unified counterparts in the final central structure. These tables are meant to be used only up until the final system goes live in June 2007.

## **CONFIGURATION OF SERVERS**

During this reporting period we worked with ADF&G network services staff to integrate the two servers purchased in January of 2005 with FIS 04-701 funds into the Anchorage office network. This integration ensures more unified backups, maintenance, and software upgrades. We currently have Windows 2003 installed on both. One of the servers is currently being used to test Microsoft Sharepoint Services.

## **AGE, SEX, AND LENGTH DATA**

During the previous reporting period much time was spent on database maintenance, data entry/loading, data editing, application development, and data retrieval. During this reporting period these five aspects of the ASL component of the AYK salmon DBMS continued to be addressed. Much of the work directed towards ASL data until now was funded by other projects (Figures 2 and 3).

Database maintenance involved updates and changes to the centralized Microsoft SQL database structure. Tables were altered to allow the geo-referencing of ASL data to the DBMS’s master location table. Decisions were made on the applicability and storage of commercial fishing subdistricts and the database scheme was altered accordingly. Also, the ASL scale inventory was converted from an Excel spreadsheet to a database table, and links between the inventory and the ASL database tables were added. Other than potential modifications to allow for the association of extraneous data (such as genetic sample or tag number), the ASL database structure is expected to change little in the future.

A thorough ASL error correction effort was undertaken during this reporting period. This effort was funded by Yukon River Restoration and Enhancement Fund and focused on Yukon data most in need of editing. Queries were written to manifest erroneous or suspect data, which a technician then reviewed and corrected if necessary. These queries examined raw fish data (age, length, and sex) as well as header data (project type, gear type, mesh, commercial fishing period, etc). The technician also compared data summary queries to published reports to identify problems in header data. In conjunction with the data editing, the technician also performed data entry tasks for 160 Yukon chum and coho files which did not exist in the database. In July, State of Alaska general funding was used for a student intern to enter an additional 23 files. An estimated 163 files still remain to be entered.

There were corrections and additions made to the Access front end database that was developed the last reporting period for inseason data entry and editing. These corrections and additions included fixing bugs in the system and adding functionality that was requested by the biologists using the system. Several additional inseason reports and data outputs were added to assist technicians in data analysis and maintenance. Also during this reporting period postseason ASL

reports (brood tables) were developed. These databases were used in our local area offices of Nome and Emmonak to load 2005 data from Norton Sound and the Yukon River. We completed the loading of both 2004 data (by August 2004) and 2005 data (by March, 31, 2006) into the SQL central database.

Through 2005, 4,036 files of ASL data are thought to exist where each file represents a year, species and project combination (Table 2). A file's existence was based on references in reports, availability of scale cards, paper records or as inventoried by Hamner et al. (2002; 2003b). The total number of files changes as new data are collected, previously unknown files are discovered, and files are combined or divided according to newly discovered attributes (e.g. distinct mesh sizes or multiple species). Of the estimated total, 93.2% or 3,776 files have been located, 96.1% or 3,613 of which have been loaded into the AYK salmon DBMS SQL database. Coverage varies by species and area, with the greatest recovery occurring for the Kuskokwim area (over 94%).

During this reporting period access to the ASL database was given to Division of Commercial Fisheries AYK and Mark, Tag, and Age Laboratory employees behind the State's firewall with a State of Alaska email account. This allowed these employees to view the ASL inventory, extract data, and enter into the database whether the salmon scales and or scale impressions (acetates) associated with electronic data sets have been loaned out. This has freed up time for the associated IT staff working on the ASL component of the DBMS.

## **ESCAPEMENT DATA**

During this reporting period we were to address the project objective "to standardize and error check aerial survey data residing in intermediate databases." During the last reporting period, aerial survey data through 2004 was entered by a technician into a standardized Access database. The technician had full access to area staff when questions arose and was able to complete this task in enough time that he went through and double checked all the data that he had entered. IT staff also ensured that all data loaded from electronic files were loaded correctly. During the process of refining and finalizing Access-to-intermediate SQL import scripts, we found and corrected minor anomalies within the aerial survey data. Also during this reporting period, deployment of Access aerial survey databases were initiated, primarily to enter 2005 data. However, this application enables area staff to examine and edit past year's data, and they are being encouraged to do so. Lastly, we worked with staff to update the data collection form (paper) for 2005 aerial surveys to ensure standard data collection. Data collected in 2005 has been loaded into the SQL central database.

## **PROJECT LISTING DATABASE**

During this reporting period the project database of Brannian et al. (2005b) was migrated to Microsoft SQL and restructured to become the top tier of the centralized SQL database. The project database contains project names, locations, and operating agencies and hence will be the most likely point of entry for users looking for data in the DBMS. Project naming conventions were developed and data storage protocols were standardized. All existing projects were reviewed and adjusted to fit the new conventions, and some projects were combined or eliminated. The database was then expanded to include general escapement projects (carcass surveys and other sampling not related to other projects), new projects, and biologist revisions. Many new projects had to be added to accommodate the general escapement data in the ASL database. Besides the addition of the projects, this involved adding locations and researching



geographic coordinates. Tables containing staff information were also expanded and missing contact information was researched and entered. Projects funded by the Norton Sound Salmon Research and Restoration fund were added, and project information for 2005 was updated as biologists submitted their annual data. The database now consists of 274 projects beginning in 1953 (Table 3). Information for each project includes project name, project type, description, years of operation, contact information, participating agencies and project leaders, and locations.

## **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, and metadata standard version.

Metadata records were completed for the metadata structure described by Brannian et al. (2005b) during the last reporting period. Metadata records now exist for each area (Kuskokwim, Yukon, Norton Sound/Port Clarence or Kotzebue), salmon species (Chinook, chum, coho, sockeye, or pink) and data type (ASL, escapement count, escapement survey, or test fish) combination (Table 4). New this reporting period was the addition of Norton Sound and Kotzebue test fish metadata which accompanied the addition of test fish data to the AYK salmon DBMS. Metadata are currently stored in the SIMMS version 5.1 software. Each metadata record as retrieved from SIMMS is currently about 6 pages long (Appendix A1).

Metadata includes an informative abstract, data purpose, description of methodology, and citations. We attempted to cite recent publications documenting methods and examples of project analysis and reporting of these data. Excerpts of metadata records for ASL data (Appendix A2), escapement count data (Appendix A3), escapement survey data (Appendix A1) and test fish data (Appendix A4) illustrate the current level of description in these metadata. Similar levels of description were developed for all metadata records in Table 4.

## **DISCUSSION**

Objectives for the period from July 1, 2005 to June 30, 2006 of the Norton Sound Information Database project and USFWS OSM Shared Fishery Database project were fulfilled. Structure for the central database was finalized and populated with data from intermediate SQL databases. Metadata and project listing data were updated. ASL and escapement survey data were edited and all 2005 data were loaded.

Preliminary metadata developed around our initial framework was completed last reporting period and updated for this report. Metadata should not be considered complete prior to the end of this project, but will be updated annually. The complexity and detail provided in a metadata record may increase as we understand how it will benefit our users. Additionally, it is questionable whether metadata posted for general viewing should occur prior to the underlying data being available through the Internet (goal for June 30, 2007). Metadata will be addressed every year as an objective and presented to users annually for comment.

During this project reporting period, ASL and escapement survey data remained to be edited. A seasonal technician on a US/Canada Treaty funded project verified and corrected as necessary all Yukon River ASL data and hand entered additional files. Also completed was editing of Kuskokwim Area ASL data. A technician also reviewed all survey data entered during the last reporting period. Every opportunity to query the database was used by us to edit and verify data. We have also used the development and testing of applications as an opportunity to further verify the data. Lastly, as data were migrated from intermediate to the final central database, data were again reviewed and edited as appropriate. During the review process for survey data, Yukon River staff became concerned for additional detailed editing of some data. For example, editing of Yukon River survey data (aerial, ground, and boat) conducted in the late 1990s may not have been completed. Paper copies of survey results with editorial comments were discovered in the Fairbanks office. Staff recommends hiring a technician under the direction of a biologist to see if those edits were done to the electronic version of the data that was ultimately loaded into the AYK salmon DBMS.

Though this project is not scheduled for completion until June 30, 2007 (Brannian et al. 2004), requests for data retrievals have increased from ADF&G, federal agencies, non-government organizations (NGO), and private consultants. The ASL database has become an asset to the region as data retrievals are saving project leaders time responding to data requests or preparing escapement goal reviews. ASL data have been extracted from the database for use by researchers employed by US Geological Service, Natural Resources Consultants, Inc, and ADF&G biologists in Anchorage, Nome, and Juneau. USFWS biologists Hyer and Schleusner (2005) obtained Yukon Chinook salmon ASL data from the DBMS to test for changes in fish size through time. A fishery biologist for the University of Alaska Fairbanks, in his joint working capacity for the Bering Sea Fisherman's Association, has also made multiple ASL data requests. The project's scope of work (Brannian et al. 2004) has been distributed upon request to a number of people within and outside ADF&G. Recently the Tanana Chiefs Conference partner's biologist requested all aerial survey data collected on the Kantishna River drainage. The project listing database has been requested by a consultant under contract from the North Pacific Research Board and Ecotrust. This project has been discussed at all ADF&G post season staff meetings with emphasis on issues of data standardization and editing.

We have also had requests for data not scheduled for inclusion in the AYK salmon DBMS prior to June 30, 2007. We emphasize that the only components scheduled or funded for inclusion are (1) ASL data, (2) escapement count data generally from weir, tower, or sonar projects, (3) escapement survey data generally from aerial, foot, or boat surveys, (4) test fish data for Norton Sound only, (5) project description data, and (6) NBII compliant metadata. Requests have included stream temperature data collected at many of our escapement count projects, test fish data from areas outside Norton Sound, and salmon brood-year-return data.

## **CONCLUSIONS FOR NORTON SOUND INFORMATION DATABASE (06-11) OBJECTIVES**

We conclude the following for the July 1, 2005 through June 30, 2006 objectives for the Norton Sound Information Database (06-11) project:

1. *Development of an integrated central database with preliminary data entry, editing, querying, reporting, and downloading capabilities.* This objective was fulfilled.

2. *Population of the central database with escapement count, escapement survey, Norton Sound test fish, and ASL data from intermediate databases.* All data have been moved into a final central SQL database.
3. *Update of metadata to account for additions to the database management system in 2005 and user comments.* Metadata records were completed for each area-species-data type combination and updated to include Norton Sound and Kotzebue test fish data.
4. *Update of intermediate project database to account for additions to the database management system in 2005 and project biologist review comments.* This objective was fulfilled.
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.* We presented the status of the AYK salmon DBMS to the Norton Sound Research and Restoration Steering Committee in Nome on January 6<sup>th</sup>, and to other interested users on February 17, 2006 in Anchorage.
6. *Entering of escapement count, aerial survey, test fish, and ASL data from 2005 into the central database.* These data have been entered.
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.* Work continues through the end of this reporting period in fulfillment of this objective.

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

We conclude the following for the July 1, 2005 through June 30, 2006 objectives for the Shared Fishery Database project (FIS 04-701):

1. *Standardize and error check aerial survey data residing in intermediate databases created in 2004.* Editing of aerial survey data by technicians has ended for aerial survey data.
2. *Standardize and error check ASL data residing in intermediate databases created in 2004; enter 2004 ASL data.* Review by this project has ended and an additional review project was completed January 2006.
3. *Develop integrated central database with preliminary data entry, editing, querying, reporting and downloading capabilities for escapement count, aerial survey, and ASL data incorporating comments from presentation February 2005.* Objective fulfilled.
4. *Populate central database with data from intermediate escapement count, aerial, survey, and ASL databases.* Objective fulfilled.
5. *Update metadata to account for additions to the database management system in 2005 and user comments.* Objective fulfilled.
6. *Update intermediate project database to account for additions to the database management system in 2005 as well as user comments.* Objective fulfilled.
7. *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. A presentation was made to interested users February on 17, 2006 in Anchorage.

8. *Entering of escapement count, aerial survey, test fish, and ASL data from 2005 into the central database.* These data have been entered.
9. *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 7 above.* Work continues through the end of this reporting period in fulfillment of this objective.

## **RECOMMENDATIONS**

We recommend the following:

1. Complete the AYK salmon DBMS through funding the final year of the Norton Sound Salmon Research and Restoration Project 07-11, Norton Sound Salmon Information Database.
2. Incorporate user comments from the February 2006 presentation into the AYK salmon DBMS.
3. Respond to project leader concern for additional detailed editing of some data. For example, Yukon River staff are concerned that edits to survey data (aerial, ground, and boat) conducted in the late 1990s were never completed. Paper copies of survey results with editorial comments were discovered in the Fairbanks office. Staff recommends hiring a technician under the direction of a biologist to see if those edits were done to the electronic version of the data that was ultimately loaded into the AYK salmon DBMS. Prepare a proposal to the Yukon River US/Canada Research and Restoration fund to support this editing and loading of Canadian data not currently in our database.
4. Delay the presentation now scheduled February 2007 to March 2007 to allow interested users to test web access to the first version of the AYK salmon DBMS.

## **ACKNOWLEDGEMENTS**

The National Oceanic and Atmospheric Administration under Cooperative Agreement NA16FW1272 for Research and Prevention Relative to the 1999 Norton Sound Fishery Disaster provided \$44,258 in funding support for this project (06-11 *Norton Sound Salmon Information Database*). The USFWS OSM provided \$30,703 in funding support to ADF&G for project FIS 04-701 through the Fisheries Resource Monitoring Program, under agreement number 701814J580. We thank Carmine DiCostanzo and Jamie Stafford 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. Seth Darr should be acknowledged for his instrumental work as co-investigator and IT unit supervisor during the first 2 years of this project.

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## **TABLES AND FIGURES**

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

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Equipment purchased under the NSSRR project <sup>a</sup>:

Web/database server

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

Software

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

Equipment purchased under project FIS 04-701 and SOA <sup>b</sup> funds:

Web server

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

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<sup>a</sup> NSSRR project is funded by the Norton Sound Salmon Research and Restoration fund.

<sup>b</sup> SOA is state of Alaska and includes general funds and other monies available to the AYK Region.



**Table 2.**—Estimated number and status of age, sex, and length data files by area and salmon species for the AYK Region, May 9, 2006.

<b>AYK Age-Sex-Length Data Inventory Summary</b>							
<b>Area</b>	<b>Species</b>	<b>Approximate Total Number of Files</b>	<b>In Database</b>	<b>To be Added</b>	<b>Missing Files</b>	<b>% Found ASL Data Loaded Into Database</b>	<b>% Total Estimated ASL Data Recovered</b>
Kotzebue	Chinook	5	4	0	1	100.0%	80.0%
	Sockeye	6	5	0	1	100.0%	83.3%
	Coho	3	2	0	1	100.0%	66.7%
	Pink	2	1	0	1	100.0%	50.0%
	Chum	184	158	8	23	98.1%	87.5%
	<i>Total Files</i>	<i>200</i>	<i>170</i>	<i>8</i>	<i>27</i>	<i>98.3%</i>	<i>86.5%</i>
Port Clarence	Chinook	4	3	0	1	100.0%	75.0%
	Sockeye	10	8	1	1	88.9%	90.0%
	Coho	3	3	0	0	100.0%	100.0%
	Pink	-	-	-	-	-	-
	Chum	5	5	0	0	100.0%	100.0%
	<i>Total Files</i>	<i>22</i>	<i>19</i>	<i>1</i>	<i>2</i>	<i>95.0%</i>	<i>90.9%</i>
Norton Sound	Chinook	123	110	8	7	94.8%	94.3%
	Sockeye	10	8	1	1	88.9%	90.0%
	Coho	102	97	1	4	99.0%	96.1%
	Pink	15	1	12	2	7.7%	86.7%
	Chum	226	177	29	20	85.9%	91.2%
	<i>Total Files</i>	<i>476</i>	<i>393</i>	<i>51</i>	<i>34</i>	<i>88.9%</i>	<i>92.9%</i>
Yukon	Chinook	1,070	968	46	62	96.0%	94.2%
	Sockeye	18	16	1	1	94.1%	94.4%
	Coho	190	175	0	15	100.0%	92.1%
	Pink	2	2	0	0	100.0%	100.0%
	Chum	946	837	31	78	96.4%	91.8%
	<i>Total Files</i>	<i>2,226</i>	<i>1,998</i>	<i>78</i>	<i>156</i>	<i>96.5%</i>	<i>93.0%</i>
Kuskokwim	Chinook	344	318	11	16	97.0%	95.3%
	Sockeye	231	215	3	13	98.6%	94.4%
	Coho	207	198	1	9	100.0%	95.7%
	Pink	12	11	0	1	100.0%	91.7%
	Chum	318	291	10	18	97.0%	94.3%
	<i>Total Files</i>	<i>1,112</i>	<i>1,033</i>	<i>25</i>	<i>57</i>	<i>97.9%</i>	<i>94.9%</i>
<b>Total ASL Files</b>		<b>4,036</b>	<b>3,613</b>	<b>163</b>	<b>276</b>	<b>96.1%</b>	<b>93.2%</b>

**Table 3.**—Contents of the project listing database within the AYK salmon database management system, May 9, 2006.

<b>Area</b>	<b>Project Type</b>	<b>Project Name</b>	<b>Years of Operation</b>
Kotzebue	Aerial Survey	Kotzebue District Aerial Survey	1960, 1962-1988, 1990-1999, 2001-2003
	Commercial	Kotzebue District Commercial	1962-2005
	Escapement	Noatak River Escapement	1981-1983, 1991-1994
	Escapement	Squirrel River Escapement	1982, 1984
	General Escapement	Beaver Creek General Escapement (Kotzebue)	1983-1984
	General Escapement	Buckland River General Escapement	1984
	General Escapement	Ikalukrock Creek General Escapement	1984
	General Escapement	Inmachuk River General Escapement	1984
	General Escapement	Kelly Lake General Escapement	1983, 1985
	General Escapement	Kugururok River General Escapement	1983, 1985
	General Escapement	Noatak River General Escapement	1965, 1984-1985, 1990-1992, 2000
	General Escapement	Salmon River General Escapement (Kotzebue)	1983-1988, 1991-1997
	General Escapement	Selby Slough General Escapement	1983-1985, 1992, 1994-1998
	General Escapement	Sikusuilq Hatchery General Escapement	1995
	General Escapement	Squirrel River General Escapement	1980, 1984-1993, 1995-1997
	General Escapement	Wulik River General Escapement	1984
	Mark/Recapture	Kotzebue District Mark/Recapture	1966-1968, 1981-1982
	Subsistence	Kotzebue District Subsistence	1967-1968, 1977-1978, 1990
	Test Fishing	Inmachuk River Test Fishing	1984
	Test Fishing	Kelly River Test Fishing	1991
	Test Fishing	Kobuk River Test Fishing	1993-2005
	Test Fishing	Noatak River Test Fishing	1975-1984, 1987-2005
	Test Fishing	Sheshalik Test Fishing	1981-1982
Test Fishing	Wulik River Test Fishing	1984	
Kuskokwim	Aerial Survey	Kuskokwim District Aerial Survey	1954, 1957-1962, 1964-2005
	Commercial	W1 Subdistrict Commercial	1961, 1964-2005
	Commercial	W2 Subdistrict Commercial	1992
	Commercial	W4 Subdistrict Commercial	1964-1965, 1967-1970, 1973-2005
	Commercial	W5 Subdistrict Commercial	1963, 1969, 1973-1974, 1977-1978, 1980-2005
	Escapement	Aniak River Escapement	1980-2005
	Escapement	George River Escapement	1996-2005
	Escapement	Kanektok River Escapement	1960-1962, 1982-1987, 1996-2005
	Escapement	Kogrukruk River Escapement	1969-2005
	Escapement	Kuskokwim River Escapement	1993-1995
	Escapement	Kwethluk River Escapement	1978-1979, 1992, 1996-2005
	Escapement	Middle Fork Goodnews River Escapement	1981-2005
	Escapement	Salmon River Escapement (Kuskokwim)	1981-1982
	Escapement	Takotna River Escapement	1995-2005
	Escapement	Tatlawiksuk River Escapement	1998-2005
	Escapement	Tuluksak River Escapement	1991-1994, 2001-2005
	General Escapement	Aniak General Escapement	1982, 1985, 1989, 1995
	General Escapement	Arolik General Escapement	1976
	General Escapement	Eek River General Escapement	1989
	General Escapement	Goodnews Bay General Escapement	1983

-continued-

**Table 3.**–Page 2 of 7.

<b>Area</b>	<b>Project Type</b>	<b>Project Name</b>	<b>Years of Operation</b>
Kuskokwim	General Escapement	Goodnews Lake General Escapement	1967, 1984, 1989
	General Escapement	Goodnews River (North Fork) General Escapement	1989
	General Escapement	Goodnews River General Escapement	1983-1987, 1989-1990
	General Escapement	Kagati Lake General Escapement	1988-1989
	General Escapement	Kanektok River General Escapement	1983-1987, 1989
	General Escapement	Kipchuk River General Escapement	1989
	General Escapement	Kisaralik River General Escapement	1986, 2001
	General Escapement	Kogruklu River General Escapement	1968, 1987, 1990
	General Escapement	Kwethluk River General Escapement	1989, 1991, 2001
	General Escapement	Nikolai General Escapement	2004
	General Escapement	NYAC Escapement	1987-1988
	General Escapement	Salmon River (Aniak) General Escapement	1989
	General Escapement	Salmon River (Pitka Fork) General Escapement	1989
	General Escapement	Stony River General Escapement	1989
	Mark/Recapture	Birch Tree Mark/Recapture	2002
	Mark/Recapture	Kalskag Mark/Recapture	2002
	Mark/Recapture	Kuskokwim River Mark/Recapture	1995, 2001-2005
	Mark/Recapture	Quinhagak Mark/Recapture	1969-1970
	Radio Telemetry	Holitna River Radio Telemetry	2001-2004
	Radio Telemetry	Kuskokwim River Radio Telemetry	2002-2005
	Research	Kuskokwim River Research	2004
	Stock Identification	Kuskokwim Area Stock Identification	2002-2006
	Subsistence	Kuskokwim District Subsistence	1964, 1970, 1980, 1986-1987, 1991-1995, 2005
	Test Fishing	Aniak Test Fishing	1992-1995
	Test Fishing	Bethel Test Fishing	1980-1981, 1983-2005
	Test Fishing	Chuathbaluk Test Fishing	1992-1993
	Test Fishing	Eek Test Fishing	1988-1990, 1992-1995
	Test Fishing	Kuskokwim River Test Fishing	1966, 1988-1990
	Test Fishing	Kwegooyuk Test Fishing	1966-1983
	Test Fishing	Lower Kuskokwim River Test Fishing	1995
Test Fishing	Tuluksak Test Fishing	1961-1962	
Norton	Aerial Survey	Norton Sound District Aerial Survey	1958-2005
Sound	Commercial	Golovin Bay Subdistrict Commercial	1963, 1985-1986
	Commercial	Moses Point Subdistrict Commercial	1962-1963, 1967-1969, 1975, 1977-1978, 1982-1983, 1985-1991
	Commercial	Nome Subdistrict Commercial	1978, 1980
	Commercial	Norton Bay Subdistrict Commercial	1962-1963, 1975
	Commercial	Shaktoolik Subdistrict Commercial	1986, 1989-1991, 1994, 1996, 1998, 2001-2005
	Commercial	Unalakleet Subdistrict Commercial	1962-1963, 1967-2005
	Enhancement/Restoration	Anvil Creek Enhancement/Restoration	1998-2000
	Enhancement/Restoration	Boulder Creek Enhancement/Restoration	1991-1998
	Enhancement/Restoration	Coral Creek Enhancement/Restoration	1991-1998, 2000
	Enhancement/Restoration	Hobson Creek Enhancement/Restoration	1998-1999
	Enhancement/Restoration	Kwiniuk River Enhancement/Restoration	1998

-continued-

**Table 3.**—Page 3 of 7.

<b>Area</b>	<b>Project Type</b>	<b>Project Name</b>	<b>Years of Operation</b>
Norton	Enhancement/Restoration	Shovel Creek Enhancement/Restoration	1995-1998
Sound	Enhancement/Restoration	Sinuk River Enhancement/Restoration	1998
	Environmental Conditions Monitoring	Eldorado River Environmental Conditions Monitoring	2003-2005
	Environmental Conditions Monitoring	Nome River Environmental Conditions Monitoring	2003-2005
	Environmental Conditions Monitoring	Snake River Environmental Conditions Monitoring	2003-2005
	Escapement	Chirosky River Escapement	1975-1976
	Escapement	Eldorado River Escapement	1995-2005
	Escapement	Glacial Lake Escapement	1979, 2000-2005
	Escapement	Kachauvik River Escapement	1977-1978
	Escapement	Kwiniuk River Escapement	1965-2005
	Escapement	Niukluk River Escapement	1979, 1995-2005
	Escapement	Nome River Escapement	1993-2005
	Escapement	North River Escapement	1972-1974, 1984-1986, 1996-2005
	Escapement	Nunakogak River Escapement	1992
	Escapement	Pikmiktalik River Escapement	1992, 2003-2005
	Escapement	Shaktoolik River Escapement	1996-1998
	Escapement	Snake River Escapement	1995-2005
	Escapement	Tubutulik River Escapement	1980
	Escapement	Unalakleet River Escapement	1983-1985
	General Escapement	Boston Creek General Escapement	1978
	General Escapement	Eldorado River General Escapement	1978, 2001, 2003
	General Escapement	Fish River General Escapement	1977-1978
	General Escapement	Kachauvik River General Escapement	1978
	General Escapement	Kwiniuk River General Escapement	1977, 1985, 1996, 2000, 2005
	General Escapement	Niukluk River General Escapement	1977-1979, 1996
	General Escapement	North River General Escapement	1983, 1997
	General Escapement	Sinuk River General Escapement	1978
	General Escapement	Unalakleet River General Escapement	1975-1976, 1978, 1983, 1997
	Mark/Recapture	Nome Subdistrict Mark/Recapture	1978-1979
	Mark/Recapture	Unalakleet River Mark/Recapture	1972-1975
	Radio Telemetry	Fish River Radio Telemetry	2002-2005
	Radio Telemetry	Unalakleet River Radio Telemetry	1997-1998, 2004-2005
	Research	Fish River Research	2004-2005
	Research	Norton Sound Area Research	2001-2007
	Research	Safety Sound Research	2002
	Research	Unalakleet River Research	2002-2005
Smolt Research	Nome River Smolt Research	2003	
Smolt Research	North River Smolt Research	2003	
Smolt Research	Osborn Creek Smolt Research	2003	
Sport Fishing (freshwater)	Nome River Sport Fishing	1963	
Sport Fishing (marine)	Shaktoolik Marine Sport Fishing	1989	
Stock Identification	Norton Sound Area Stock Identification	1978-1979, 2005	
Subsistence	Norton Sound District Subsistence	1974, 1977-1979, 1981, 1983, 1986-1989, 1991-1993, 1995-1996, 2001-2002, 2005	
Test Fishing	Unalakleet River Test Fishing	1981-2005	

-continued-

**Table 3.**–Page 4 of 7.

<b>Area</b>	<b>Project Type</b>	<b>Project Name</b>	<b>Years of Operation</b>
Port Clarence	Aerial Survey	Port Clarence District Aerial Survey	1960-1961, 1963-1969, 1971-1980, 1983-2005
	Enhancement/Restoration	Pilgrim River Enhancement/Restoration	1995-1996, 1998-2000, 2002-2005
	Enhancement/Restoration	Salmon Lake Enhancement/Restoration	1995-2005
	Environmental Conditions Monitoring	Pilgrim River Environmental Conditions Monitoring	2003-2004
	Escapement	Pilgrim River Escapement	1997-1998, 2000, 2002-2005
	General Escapement	Salmon Lake General Escapement	1963, 1966, 1977
	Subsistence	Port Clarence District Subsistence	Unknown
Yukon	Aerial Survey	Yukon District Aerial Survey	1953-2005
	Commercial	Y1 Subdistrict Commercial	1963-2005
	Commercial	Y2 Subdistrict Commercial	1973, 1982-2005
	Commercial	Y3 Subdistrict Commercial	1964, 1968, 1970-1971, 1973, 1983-1985
	Commercial	Y4 Subdistrict Commercial	1967, 1973-1999, 2003
	Commercial	Y5 Subdistrict Commercial	1971-1999, 2002-2004
	Commercial	Y6 Subdistrict Commercial	1965, 1969-1982, 1984-1999, 2001-2005
	Enhancement/Restoration	Toklat River Enhancement/Restoration	1992-1999
	Escapement	Anvik River Escapement	1972-2005
	Escapement	Barton Creek Escapement	1994-1996
	Escapement	Beaver Creek Escapement	1996-2000
	Escapement	Big Salmon River Escapement	1985-1987
	Escapement	Blind Creek Escapement	1997-2000
	Escapement	Bluff Cabin Slough Escapement	1980-2005
	Escapement	Chandalar River Escapement	1986-1990, 1995-2005
	Escapement	Chandindu River Escapement	1999-2005
	Escapement	Chatanika River Escapement	1998-2005
	Escapement	Chena River Escapement	1993-2005
	Escapement	Clear Creek Escapement	1995-2005
	Escapement	Delta River Escapement	1971-2005
	Escapement	East Fork Andreafsky River Escapement	1981-1988, 1994-2005
	Escapement	Fishing Branch River Escapement	1972-1975, 1985-2005
	Escapement	Gisasa River Escapement	1994-2005
	Escapement	Henshaw Creek Escapement	1999-2005
	Escapement	Kaltag River Escapement	1991-2005
	Escapement	Kateel River Escapement	2002
	Escapement	Melozitna River Escapement	1981-1983
	Escapement	Nulato River Escapement	1994-2005
	Escapement	Salcha River Escapement	1993-2005
	Escapement	Sheenjek River Escapement	1981-2005
	Escapement	South Fork Koyukuk River Escapement	1990, 1996-1999
	Escapement	Tanana River Escapement	1981
	Escapement	Tatchun Creek Escapement	1997-2000
	Escapement	Toklat River Escapement	1994-1996, 2001
Escapement	Tozitna River Escapement	2001-2005	
Escapement	Whitehorse Dam Fishway Escapement	1959-2005	
Escapement	Yukon Border Escapement	1992-1994	
Escapement	Yukon River Escapement	1986-2005	

-continued-

**Table 3.**–Page 5 of 7.

<b>Area</b>	<b>Project Type</b>	<b>Project Name</b>	<b>Years of Operation</b>
Yukon	General Escapement	Anvik River General Escapement	1967-1968, 1972-1983, 1985, 1987-1989, 1991-2004
	General Escapement	Barton Creek General Escapement	1990
	General Escapement	Bear Feed Creek General Escapement	1987, 1989
	General Escapement	Bear River General Escapement	1972
	General Escapement	Big Salmon River General Escapement	1980-1990
	General Escapement	Blind Creek General Escapement	1982
	General Escapement	Caribou Creek General Escapement	1981
	General Escapement	Carmacks General Escapement	1973
	General Escapement	Chena River General Escapement	1974-1975, 1980-2004
	General Escapement	Chulitna River General Escapement	1989
	General Escapement	East Fork Andreafsky General Escapement	1967, 1980-1993
	General Escapement	Gisasa River General Escapement	1982, 1987-1989
	General Escapement	Goodpaster River General Escapement	1990-1992, 2000
	General Escapement	Henshaw Creek General Escapement	1987
	General Escapement	Ingersoll Islands General Escapement	1982-1983, 1988-1989
	General Escapement	Innoko River General Escapement	2002
	General Escapement	Jim River General Escapement	1986-1988
	General Escapement	Kaltag General Escapement	1997, 2001
	General Escapement	Kluane River General Escapement	1974, 1982-1986
	General Escapement	Koidern River General Escapement	1985
	General Escapement	Koyukuk River General Escapement	1986-1987
	General Escapement	Little Salmon River General Escapement	1980-1990
	General Escapement	McQuesten River General Escapement	1990
	General Escapement	Melozitna River General Escapement	1981-1982
	General Escapement	Michie Creek General Escapement	1980, 1982-1983
	General Escapement	Minto General Escapement	1966, 1983, 1985-1987
	General Escapement	Morley River General Escapement	1982, 1987, 1989-1990
	General Escapement	Nenana General Escapement	2000-2001
	General Escapement	Nisutlin River General Escapement	1972, 1980-1990
	General Escapement	Nordenskiold River General Escapement	1987, 1989-1990
	General Escapement	Nulato General Escapement	1971
	General Escapement	Old Crow General Escapement	1972
	General Escapement	Pelly River General Escapement	1973
	General Escapement	Porcupine River General Escapement	1972, 1985
	General Escapement	Rodo River General Escapement	1989
	General Escapement	Ross River General Escapement	1981-1982, 1988-1989
	General Escapement	Salcha River General Escapement	1966, 1968, 1970, 1972-2004
	General Escapement	Sheenjek River General Escapement	1974-1978, 1981-1983, 1985-1989, 1995, 2001-2002
	General Escapement	Stevens Village General Escapement	1970
	General Escapement	Stewart River General Escapement	1973
	General Escapement	Swift River General Escapement	1980-1981, 1989
	General Escapement	Takhini River General Escapement	1982, 1988, 1990
	General Escapement	Tanana River General Escapement	1970, 1992-1993, 2004
	General Escapement	Tatchun Creek General Escapement	1966, 1980-1990

-continued-

**Table 3.**–Page 6 of 7.

<b>Area</b>	<b>Project Type</b>	<b>Project Name</b>	<b>Years of Operation</b>
Yukon	General Escapement	Teslin General Escapement	1967-1968, 1972, 1980, 1982, 1985-1987
	General Escapement	Toklat River General Escapement	1974, 1976-1980, 1982-1989, 1991-1995, 1997-2004
	General Escapement	Tozitna River General Escapement	1989
	General Escapement	West Fork Andreafsky River General Escapement	1967-1968, 1980-1993
	General Escapement	Wolf River General Escapement	1982, 1989
	General Escapement	Yukon Crossing General Escapement	1982, 1985-1988
	Mark/Recapture	Beaver Mark/Recapture	2001-2002
	Mark/Recapture	Canadian Mainstem Yukon River Mark/Recapture	1982-1983, 1985-2005
	Mark/Recapture	Circle City Mark/Recapture	2001-2002
	Mark/Recapture	Clear Hatchery Mark/Recapture	1992-1995
	Mark/Recapture	Delta River Mark/Recapture	1973-1974
	Mark/Recapture	Galena/Ruby Mark/Recapture	1976-1980
	Mark/Recapture	Kantishna River Mark/Recapture	1976-1980, 1999-2005
	Mark/Recapture	Porcupine River Mark/Recapture	1998-2004
	Mark/Recapture	Rampart/Rapids Mark/Recapture	1972-1973, 1996-2005
	Mark/Recapture	Stevens Village Mark/Recapture	2002
	Mark/Recapture	Toklat River Mark/Recapture	1996-2005
	Mark/Recapture	Upper Tanana River Mark/Recapture	1995-2005
	Mark/Recapture	Yukon & Tanana Rivers Mark/Recapture	1976-1980
	Mark/Recapture	Yukon River Above Dawson Mark/Recapture	1974
	Mark/Recapture	Yukon River Mark/Recapture	1961-1971, 1978
	Radio Telemetry	Porcupine River Radio Telemetry	1998
	Radio Telemetry	Tanana River Radio Telemetry	1989
	Radio Telemetry	Toklat River Radio Telemetry	1997
	Radio Telemetry	Upper Tanana River Radio Telemetry	1992
	Radio Telemetry	Upper Yukon River Radio Telemetry	1982-1983
	Radio Telemetry	Yukon River Radio Telemetry	1998-2005
	Research- Disease study	Yukon Area Research	1999-2005
	Research - Juvenile chum salmon	Yukon River Research	1996-2005
	Stock Identification	Yukon Area Stock Identification	1980-2005
	Subsistence	Yukon District Subsistence	1964, 1966-1967, 1971, 1973-1980, 1982-1995, 1998-2005
	Test Fishing	Big Eddy Test Fishing	1979-2005
	Test Fishing	Emmonak Test Fishing	1981, 1990
	Test Fishing	Fish Village Test Fishing	1982-1983
Test Fishing	Flat Island Test Fishing	1963-1978	
Test Fishing	Fort Yukon Test Fishing	1995-1996	
Test Fishing	Galena Test Fishing	1995	
Test Fishing	Innoko River Test Fish	1987	
Test Fishing	Kaltag (Stink Creek) Test Fishing	1980-1985, 1999-2005	
Test Fishing	Kantishna Test Fishing	1999-2005	
Test Fishing	Manley Test Fishing	1984-1985, 1988-1993	
Test Fishing	Marshall Test Fishing	1999-2005	
Test Fishing	Middle Mouth Test Fishing	1966-1967, 1979-2005	

-continued-

**Table 3.**–Page 7 of 7.

<b>Area</b>	<b>Project Type</b>	<b>Project Name</b>	<b>Years of Operation</b>
Yukon	Test Fishing	Mountain Village Test Fishing	1995-2005
	Test Fishing	Nenana Test Fishing	1988-2005
	Test Fishing	Ohogamiut Test Fishing	1968-1971
	Test Fishing	Rampart Test Fishing	1996-2005
	Test Fishing	Rapids Test Fishing	1996-2005
	Test Fishing	Ruby Test Fishing	1980-1991
	Test Fishing	Sheep Rock Test Fishing	1989, 1991-2001
	Test Fishing	Tanana Test Fishing	1993-2005
	Test Fishing	Toklat River Test Fishing	1996-2005
	Test Fishing	Upper Kantishna Test Fishing	2000-2005
	Test Fishing	Upper Tanana Test Fishing	1995-2005
	Test Fishing	White Rock Test Fishing	1989, 1991-1994, 1996-2001

*Note:* Escapement projects are defined as projects that produce estimates of abundance (tower, weir, sonar). General escapement projects are miscellaneous sampling that does not estimate abundance (carcass sampling, beach seining, or gillnetting for age composition, etc). The current project naming convention is; project name = location + project type and may need clarification.

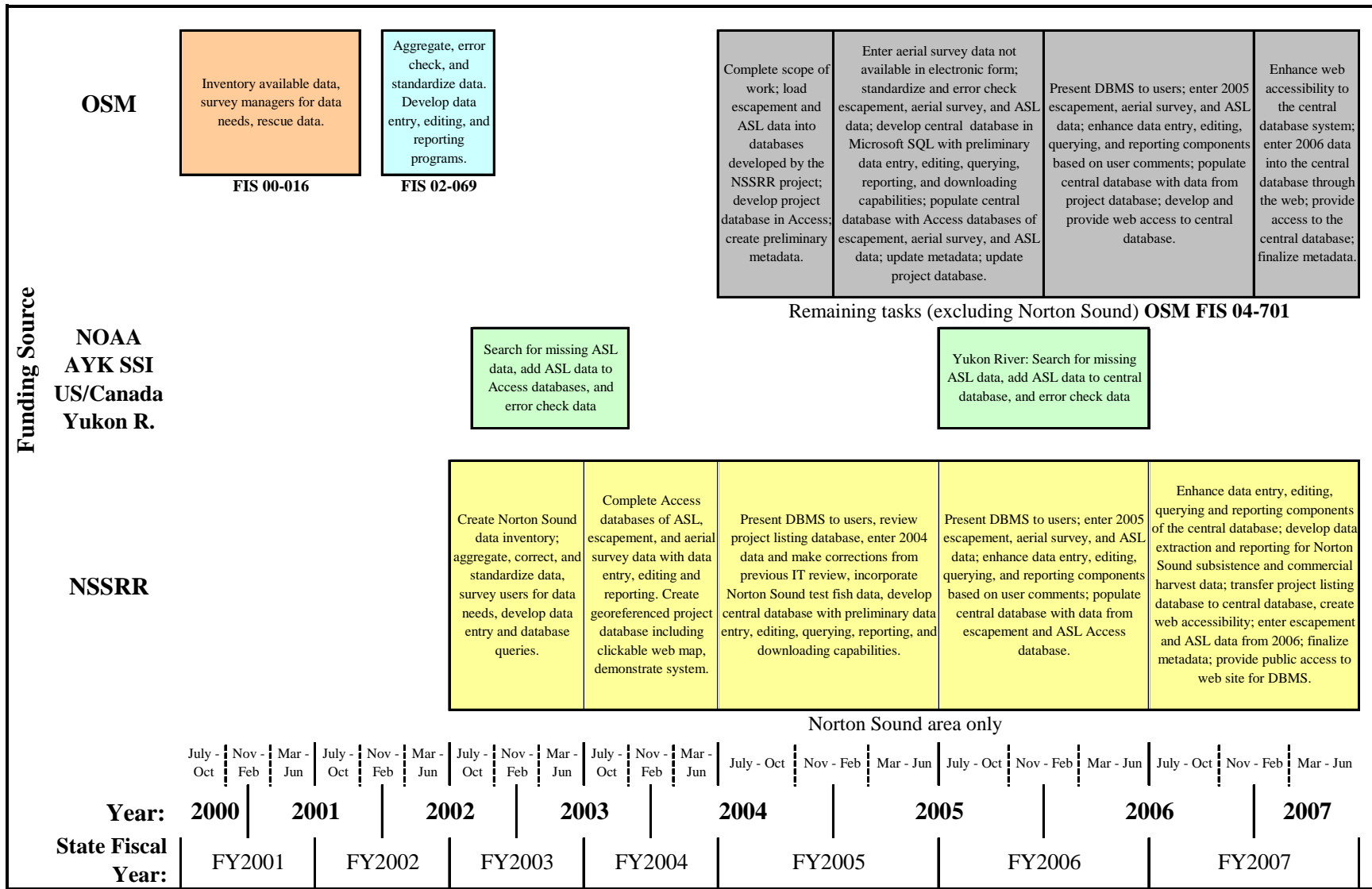


**Table 4.**–Metadata records for the AYK salmon database management system.

<b>Title of Metadata Record</b>
Norton Sound and Port Clarence Area Chinook Salmon Aerial, Boat, and Foot Survey Data
Norton Sound and Port Clarence Area Chum Salmon Aerial, Boat, and Foot Survey Data
Norton Sound and Port Clarence Area Coho Salmon Aerial, Boat, and Foot Survey Data
Norton Sound and Port Clarence Area Pink Salmon Aerial, Boat, and Foot Survey Data
Norton Sound and Port Clarence Area Sockeye Salmon Aerial, Boat, and Foot Survey Data
Norton Sound and Port Clarence Area Chinook Salmon Escapement Count Data
Norton Sound and Port Clarence Area Chum Salmon Escapement Count Data
Norton Sound and Port Clarence Area Coho Salmon Escapement Count Data
Norton Sound and Port Clarence Area Pink Salmon Escapement Count Data
Norton Sound and Port Clarence Area Sockeye Salmon Escapement Count Data
Norton Sound and Port Clarence Area Chinook Salmon Age, Sex and Size Data
Norton Sound and Port Clarence Area Chum Salmon Age, Sex and Size Data
Norton Sound and Port Clarence Area Coho Salmon Age, Sex and Size Data
Norton Sound and Port Clarence Area Sockeye Salmon Age, Sex and Size Data
Norton Sound and Port Clarence Area Pink Salmon Age, Sex and Size Data
Norton Sound and Port Clarence Area Chinook Salmon Test Fish Data
Norton Sound and Port Clarence Area Chum Salmon Test Fish Data
Norton Sound and Port Clarence Area Coho Salmon Test Fish Data
Norton Sound and Port Clarence Area Pink Salmon Test Fish Data
Kotzebue Sound Area Chum Salmon Escapement Count Data
Kotzebue Area Chum Salmon Age, Sex and Size Data
Kotzebue Area Chum Salmon Test Fish Data
Kuskokwim Area Chinook Salmon Aerial, Boat, and Foot Survey Data
Kuskokwim Area Chum Salmon Aerial, Boat, and Foot Survey Data
Kuskokwim Area Coho Salmon Aerial, Boat, and Foot Survey Data
Kuskokwim Area Sockeye Salmon Aerial, Boat, and Foot Survey Data
Kuskokwim Area Chinook Salmon Escapement Count Data
Kuskokwim Area Chum Salmon Escapement Count Data
Kuskokwim Area Coho Salmon Escapement Count Data
Kuskokwim Area Sockeye Salmon Escapement Count Data
Kuskokwim Area Chinook Salmon Age, Sex and Size Data
Kuskokwim Area Chum Salmon Age, Sex and Size Data
Kuskokwim Area Coho Salmon Age, Sex and Size Data
Kuskokwim Area Sockeye Salmon Age, Sex and Size Data
Yukon Area Chinook Salmon Aerial, Boat, and Foot Survey Data
Yukon Area Chum Salmon Aerial, Boat, and Foot Survey Data
Yukon Area Coho Salmon Aerial, Boat, and Foot Survey Data
Yukon Area Chinook Salmon Escapement Count Data
Yukon Area Chum Salmon Escapement Count Data
Yukon Area Coho Salmon Escapement Count Data
Yukon Area Chinook Salmon Age, Sex and Size Data
Yukon Area Chum Salmon Age, Sex and Size Data
Yukon Area Coho Salmon Age, Sex and Size Data
Yukon Area Sockeye Salmon Age, Sex and Size Data

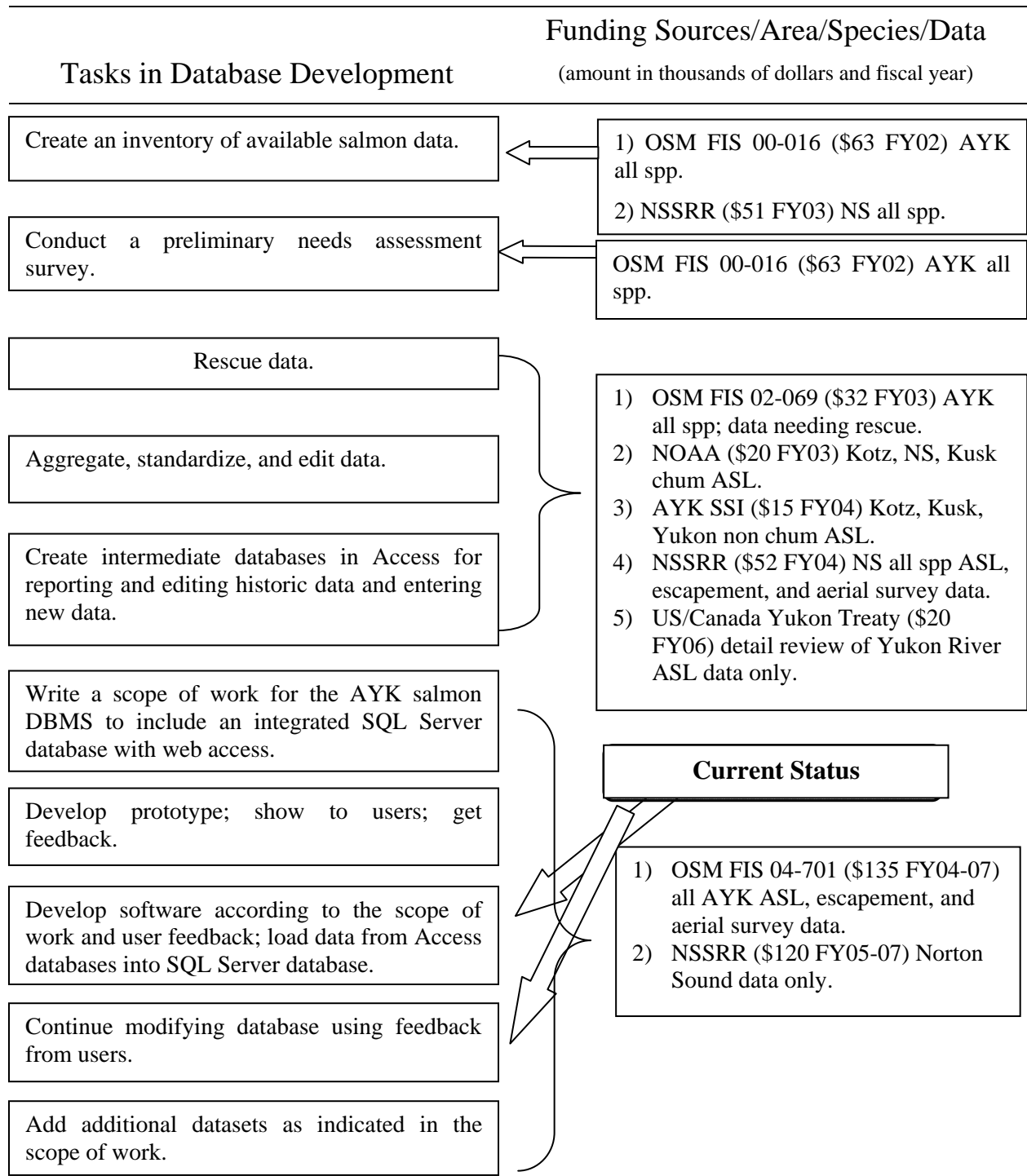


Figure 1.—AYK Region Salmon Management Areas.



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. **This timeline was updated May 15, 2006.**

**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). **This figure was updated May 15, 2006.**

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

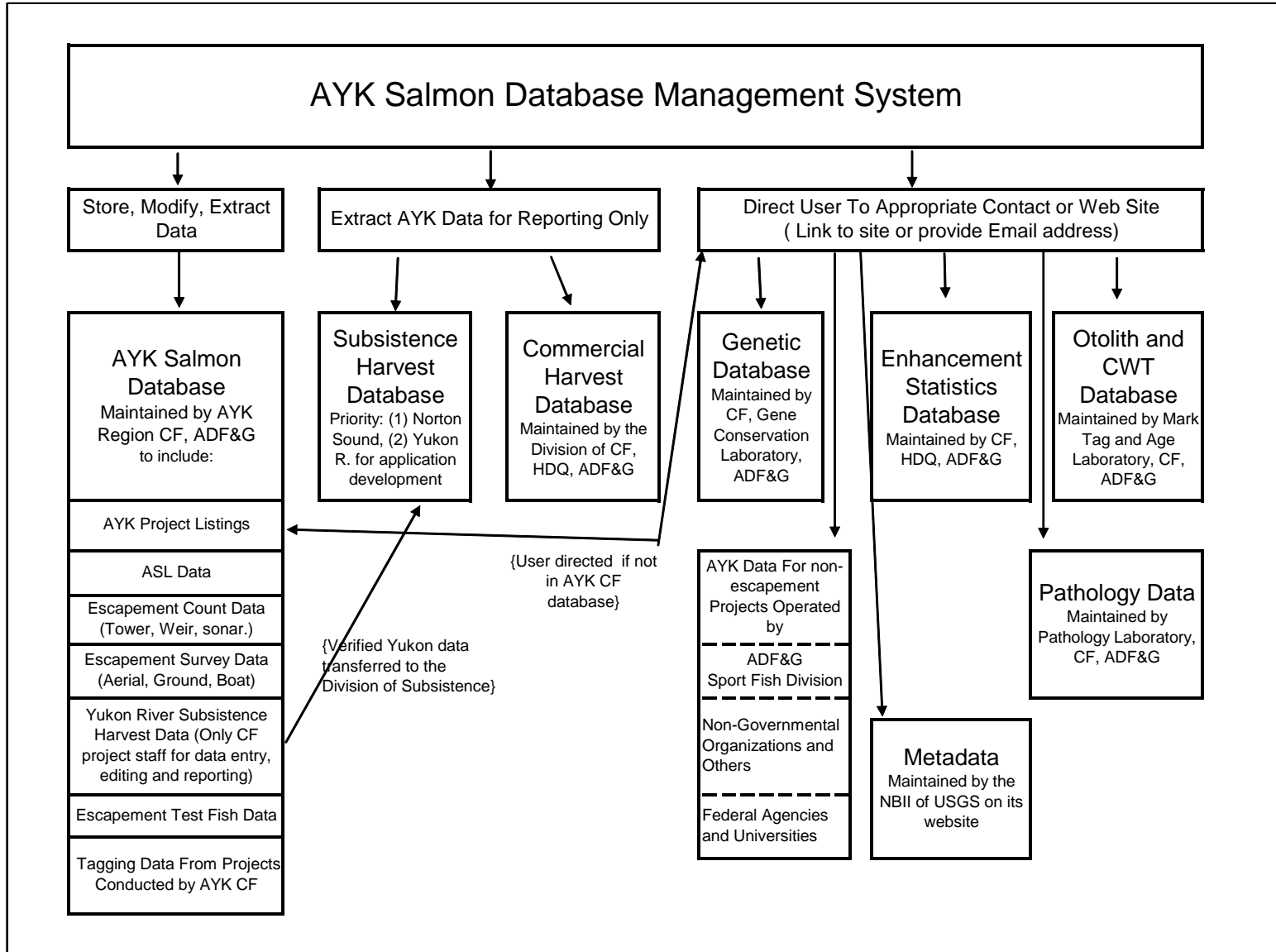
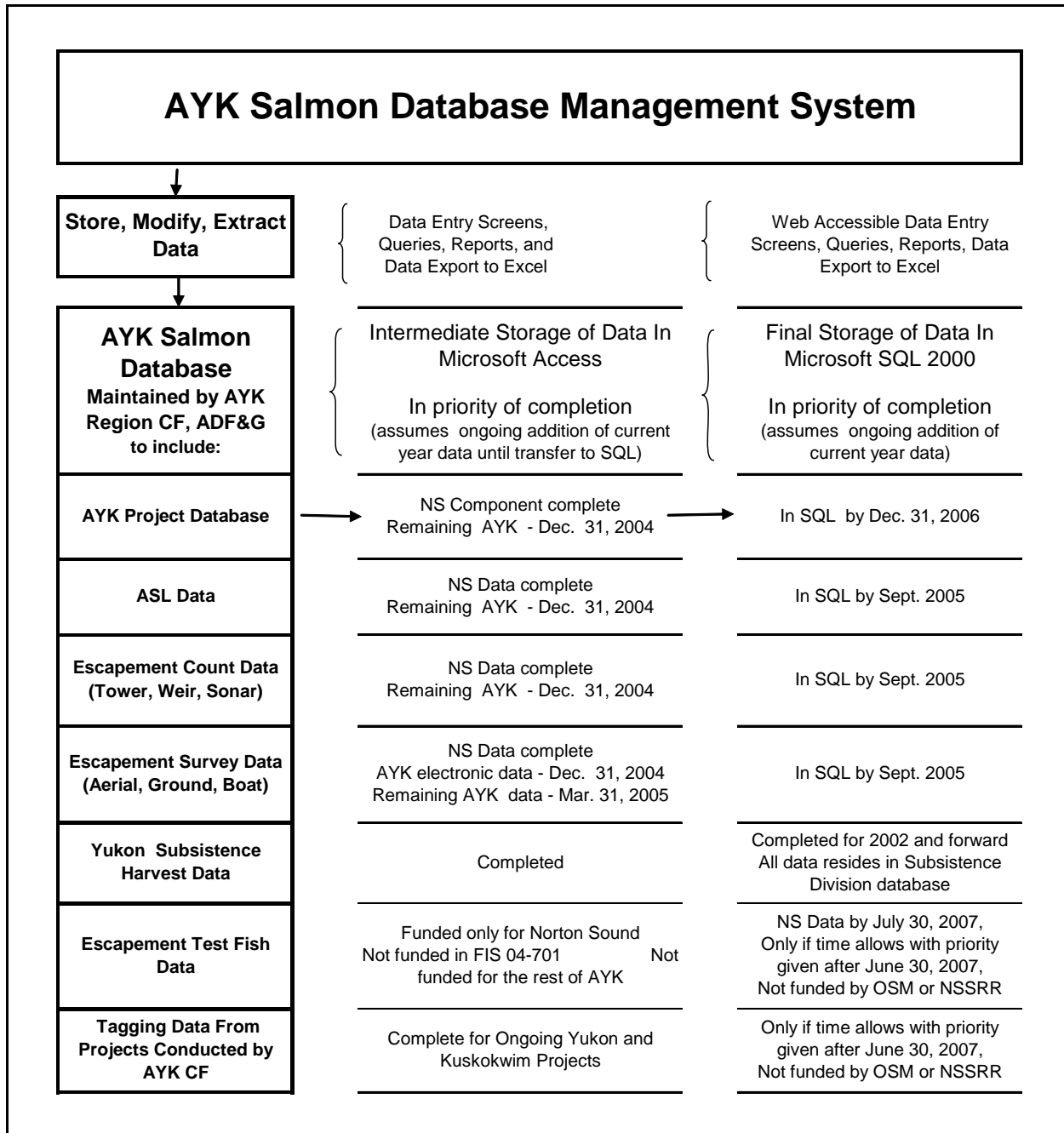
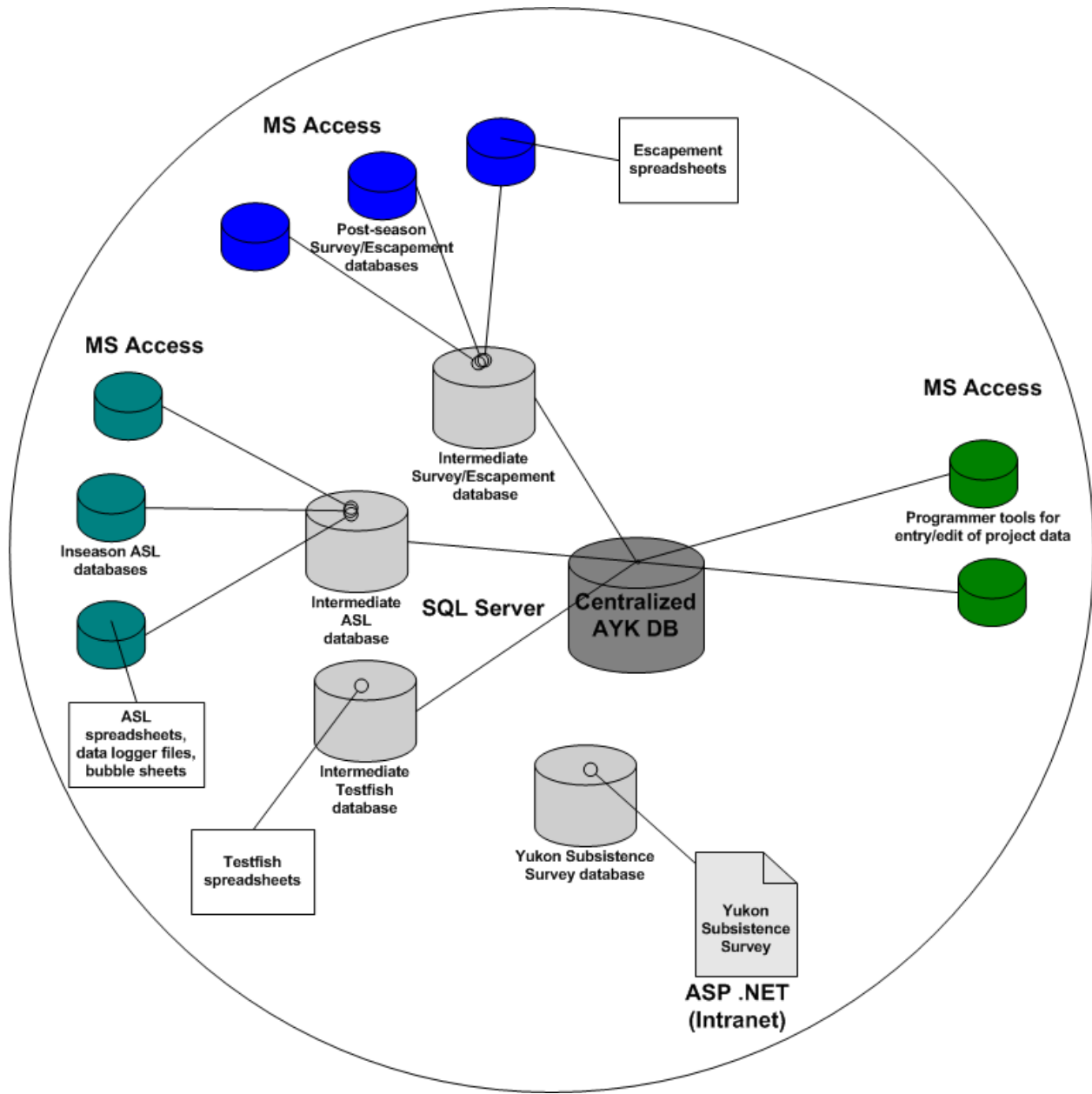


Figure 4.—Components of the AYK salmon database management system.

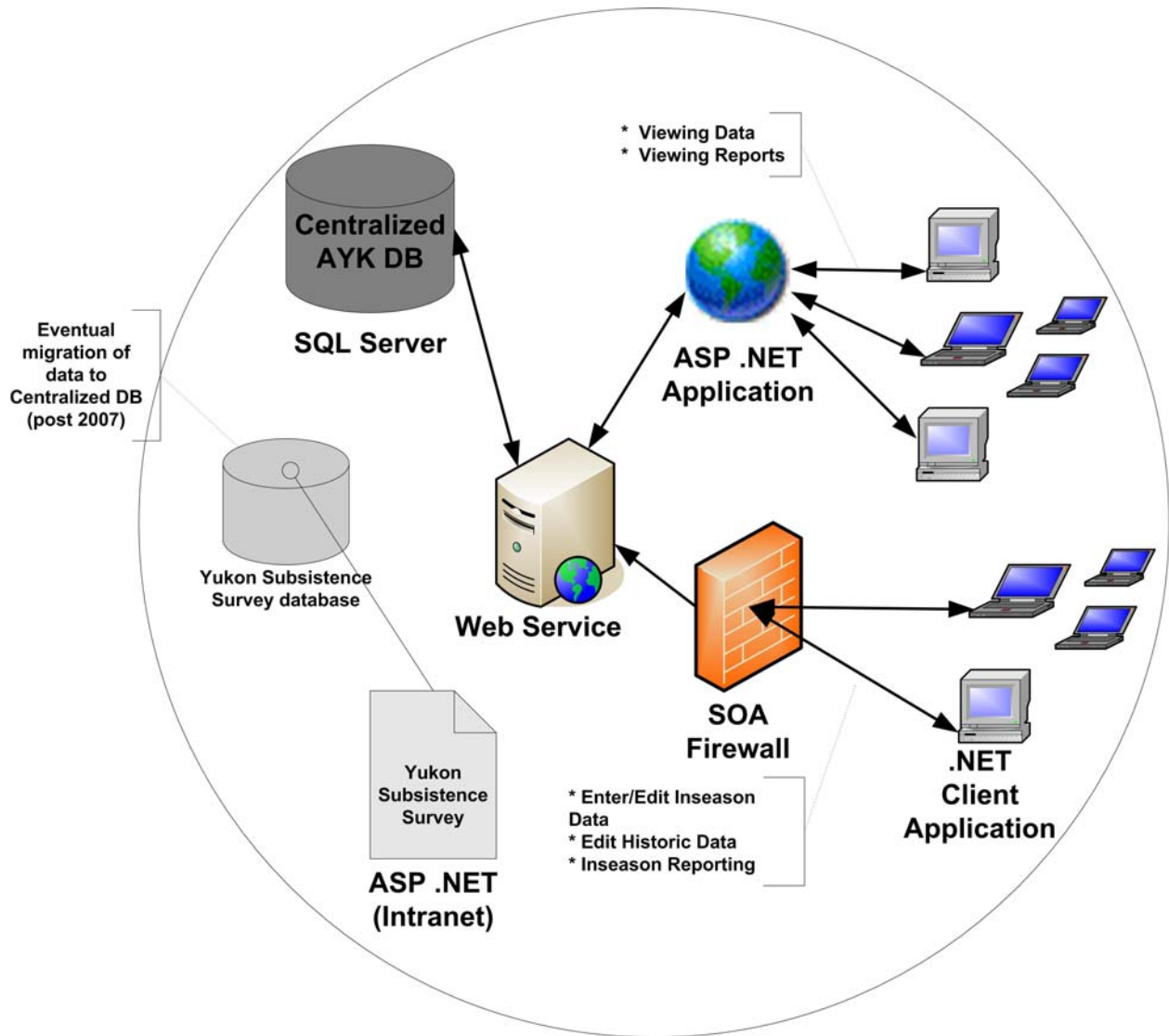


Source: Brannian et al. 2004.

**Figure 5.**—Priority and timeline for database components maintained by the Division of Commercial Fisheries AYK Region, as reported September 2004 in the project scope of work.



**Figure 6.**—Current relationship of standalone Access databases, intermediate SQL databases, and the final central database for the AYK salmon database management system.



**Figure 7.**—Final relationship among components of the AYK salmon database management system.



## **APPENDIX A**

**Appendix A1.**—Metadata record for survey data collected in the Norton Sound and Port Clarence area and included in the AYK salmon DBMS.

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## **NORTON SOUND AND PORT CLARENCE AREA CHINOOK SALMON AERIAL, BOAT, AND FOOT SURVEY DATA**

Metadata also available as

### **METADATA:**

- [Identification Information](#)
  - [Data Quality Information](#)
  - [Entity and Attribute Information](#)
  - [Distribution Information](#)
  - [Metadata Reference Information](#)
- 

#### *Identification\_Information:*

*Citation:*

*Citation\_Information:*

*Originator:*

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

*Publication\_Date:* Unpublished Material

*Publication\_Time:* Unknown

*Title:*

Norton Sound and Port Clarence Area Chinook Salmon Aerial, Boat, and Foot Survey Data

*Geospatial\_Data\_Presentation\_Form:* Database

*Description:*

*Abstract:*

This data set consists of counts of migrating, pre-, or post- spawning Chinook salmon (*Oncorhynchus tshawytscha*) in the Norton Sound and Port Clarence Area. Counts of Chinook salmon were made by observers conducting surveys using airplanes, boats, or while walking in or along the waterways. Counts do not necessarily represent total abundance but are only an index of abundance. Surveys were conducted by ADF&G, federal agencies, and non-governmental organizations. The accuracy of survey data can be highly variable and is dependent upon a number of factors such as weather and water conditions, timing of survey, altitude, experience of pilot and observer, streambed coloration, and species of salmon enumerated. Surveyors evaluate and record environmental conditions affecting survey quality, rate a survey as poor, fair, or good, and include notes helpful in data interpretation. Counts, survey location, date collected, observer, agency, and environmental conditions are included in the data set.

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-continued-

*Purpose:*

Data were collected to estimate or index spawning abundance of Chinook salmon in the rivers of the Norton Sound and Port Clarence Area. Surveys from airplanes (aerial surveys) are an efficient and cost-effective method for collecting spawning index and distribution information throughout this large and remote area. Reconnaissance surveys were flown to document distribution. Though ADF&G is the lead agency this data set includes all surveys of the drainage conducted by federal agencies and non-governmental organizations.

*Time\_Period\_of\_Content:*

*Time\_Period\_Information:*

*Range\_of\_Dates/Times:*

*Beginning\_Date:* 1958

*Beginning\_Time:* Unknown

*Ending\_Date:* Present

*Ending\_Time:* Unknown

*Currentness\_Reference:* ground condition

*Status:*

*Progress:* Complete

*Maintenance\_and\_Update\_Frequency:* Annually

*Spatial\_Domain:*

*Description\_of\_Geographic\_Extent:* Throughout rivers draining into Norton Sound or Port Clarence

*Bounding\_Coordinates:*

*West\_Bounding\_Coordinate:* -171.859131

*East\_Bounding\_Coordinate:* -158.845825

*North\_Bounding\_Coordinate:* 65.576636

*South\_Bounding\_Coordinate:* 62.876441

*Keywords:*

*Theme:*

*Theme\_Keyword\_Thesaurus:* none

*Theme\_Keyword:* spawning escapement

*Theme\_Keyword:* aerial survey

*Theme\_Keyword:* survey

*Theme\_Keyword:* salmon

*Place:*

*Place\_Keyword\_Thesaurus:* None

*Place\_Keyword:* Alaska

*Place\_Keyword:* Norton Sound

*Place\_Keyword:* Port Clarence

*Taxonomy:*

*Keywords/Taxon:*

*Taxonomic\_Keyword\_Thesaurus:* Integrated Taxonomic Information

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-continued-

*Taxonomic\_Keywords:* Chinook  
*Taxonomic\_Keywords:* salmon  
*Taxonomic\_Keywords:* king  
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*Taxon\_Rank\_Value:* Salmonidae  
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*Taxon\_Rank\_Value:* Salmoninae  
*Taxonomic\_Classification:*  
*Taxon\_Rank\_Name:* Genus  
*Taxon\_Rank\_Value:* Oncorhynchus  
*Taxonomic\_Classification:*  
*Taxon\_Rank\_Name:* Species

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-continued-

*Taxon\_Rank\_Value:* Oncorhynchus tshawytscha

*Applicable\_Common\_Name:* chinook salmon

*Applicable\_Common\_Name:* king salmon

*Use\_Constraints:*

Seek advice from the originator for appropriate use of these data and full understanding of its limitations. Data originator may also provide advice resulting in a full retrieval of your data of interest (search and selection criteria).

*Point\_of\_Contact:*

*Contact\_Information:*

*Contact\_Person\_Primary:*

*Contact\_Person:* Regional Research Biologist

*Contact\_Organization:* Alaska Department of Fish and Game, Comm. Fish, Region III

*Contact\_Position:* Regional Research Biologist

*Contact\_Address:*

*Address\_Type:* mailing and physical address

*Address:* 333 Raspberry Rd

*City:* Anchorage

*State\_or\_Province:* AK

*Postal\_Code:* 99518

*Country:* USA

*Contact\_Voice\_Telephone:* 907 267-2109

*Contact\_Facsimile\_Telephone:* 907 267-2442

*Hours\_of\_Service:* 0800 - 1630

*Data\_Set\_Credit:* Alaska Department of Fish and Game

---

*Data\_Quality\_Information:*

*Logical\_Consistency\_Report:* Data is checked for logical errors when loaded

*Completeness\_Report:*

*Lineage:*

*Methodology:*

*Methodology\_Type:* Field

*Methodology\_Description:*

Barton (1984) details aerial survey methods for the Yukon River which is applicable to the Norton Sound and Port Clarence Area. Generally an observer flies above the river of interest following its course up or downstream counting salmon by species, live and dead. Counts of salmon redds may also be included. Start and stop time and location are noted. Weather conditions are also recorded using a set of standard codes.

*Methodology\_Citation:*

*Citation\_Information:*

*Originator:* Barton, L.H.

*Publication\_Date:* 1984

*Title:* Yukon Area salmon escapement aerial survey manual

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*Series\_Information:*

*Series\_Name:*

Division of Commercial Fisheries AYK Region Yukon Salmon Escapement Report

*Issue\_Identification:* 35

*Publication\_Information:*

*Publication\_Place:* Anchorage, Alaska

*Publisher:*

Alaska Department of Fish and Game, Division of Commercial Fisheries

*Other\_Citation\_Details:* Yukon Salmon Escapement Report No. 35

*Methodology\_Citation:*

*Citation\_Information:*

*Originator:* Bevan, D.E.

*Publication\_Date:* 1961

*Title:* Variability in aerial counts of spawning salmon

*Series\_Information:*

*Series\_Name:* Journal of Fisheries Research Board of Canada

*Issue\_Identification:* 18:337-348

*Methodology\_Citation:*

*Citation\_Information:*

*Originator:* Cousens, N.B.F., G.A. Thomas, C.G. Swann, and M.C. Healey.

*Publication\_Date:* 1982

*Title:* A review of salmon escapement estimation techniques

*Series\_Information:*

*Series\_Name:* Canadian Technical Report Fisheries Aquatic Sci.

*Issue\_Identification:* 1108

*Publication\_Information:*

*Publication\_Place:* Nanaimo, B.B.

*Publisher:*

Department of Fisheries and Oceans, Pacific Biological Station, Nanaimo, B.B.

*Cloud\_Cover:* 0

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*Overview\_Description:*

*Entity\_and\_Attribute\_Overview:*

The Alaska Department of Fish and Game, Commercial Fisheries Division, Region III maintains a data dictionary for the database. This includes field types and properties.

*Entity\_and\_Attribute\_Detail\_Citation:*

For detailed attribute information contact the Alaska Department of Fish and Game, Commercial Fisheries Division, Region III, Regional Research Biologist.

---

*Distribution\_Information:*

*Distributor:*

*Contact\_Information:*

*Contact\_Organization\_Primary:*

---

-continued-

*Contact\_Organization:* Alaska Department of Fish and Game  
*Contact\_Person:* Regional Research Biologist  
*Contact\_Position:* Regional Research Biologist  
*Contact\_Address:*  
*Address\_Type:* mailing and physical address  
*Address:*  
Commercial Fisheries Divison Region III 333 Raspberry Rd  
*City:* Anchorage  
*State\_or\_Province:* AK  
*Postal\_Code:* 99518  
*Country:* USA  
*Contact\_Voice\_Telephone:* 907-267-2109  
*Contact\_Facsimile\_Telephone:* 907-267-2442  
*Hours\_of\_Service:* 0800 to 1630 hrs Alaska Time

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*Metadata\_Reference\_Information:*

*Metadata\_Date:* 20041025  
*Metadata\_Review\_Date:*  
*Metadata\_Future\_Review\_Date:*  
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*Contact\_Information:*  
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*Contact\_Person:* Regional Research Biologist  
*Contact\_Organization:* Alaska Department of Fish and Game, Comm. Fish, Region III  
*Contact\_Position:* Regional Research Biologist  
*Contact\_Address:*  
*Address\_Type:* mailing and physical address  
*Address:* 333 Raspberry Rd  
*City:* Anchorage  
*State\_or\_Province:* AK  
*Postal\_Code:* 99518  
*Country:* USA  
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*Contact\_Facsimile\_Telephone:* 907 267-2442  
*Hours\_of\_Service:* 0800 - 1630  
*Metadata\_Standard\_Name:*  
FGDC Biological Data Profile of the Content Standard for Digital Geospatial Metadata  
*Metadata\_Standard\_Version:* FGDC-STD-001.1-1999  
*Metadata\_Time\_Convention:* local time

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**Appendix A2.**—Excerpts from the Metadata record for ASL data collected in the Norton Sound and Port Clarence area and included in the AYK salmon DBMS.

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## **NORTON SOUND AND PORT CLARENCE AREA CHUM SALMON AGE, SEX AND SIZE DATA**

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### *Identification\_Information:*

*Citation:*

*Citation\_Information:*

*Originator:*

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

*Publication\_Date:* Unpublished Material

*Publication\_Time:* Unknown

*Title:*

Norton Sound and Port Clarence Area Chum Salmon Age, Sex and Size Data

*Geospatial\_Data\_Presentation\_Form:* Database

*Description:*

*Abstract:*

This data set consists of biological measurements of individual chum salmon (*Oncorhynchus keta*) sampled from fishery harvests or research projects. Biological measurements consist of length in mm generally mid-eye to fork of tail, age in European notation as judged from a scale or bony structure, and sex of the fish determined from external characteristics or internal inspection of sex organs. The location of capture for the sampled chum salmon consists of the general location of the harvest area or more specific location code for the research project (weir, tower, test fishery, etc.). Capture gear may also be included in the data record.

*Purpose:*

Data are generally collected as a sample from a larger population and the samples age, length, or sex composition will be assumed to be representative. Examples are the age composition of a harvest from an area, time, and gear combination or the estimation of the age composition of a run of salmon to a specific river.

---

### *Data\_Quality\_Information:*

*Logical\_Consistency\_Report:* Data is checked for logical errors when loaded

*Completeness\_Report:* Salmon were measured to the nearest 5mm

*Lineage:*

*Methodology:*

*Methodology\_Type:* Field

*Methodology\_Description:*

Sampling methods followed routine procedures outlined by ADF&G protocols (Kohler 2003). A scale was removed from the preferred area of each chum salmon and mounted on gum cards (INPFC 1963). Length was measured to the nearest 0.5 centimeter from mid-eye to the fork-of-the-tail using a meter stick or tape. Sex is determined by visually examining external morphological characteristics such as development of the kype, roundness of the belly, the presence or absence of an ovipositor, and overall size or by

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internal inspection of sex organs. Data are recorded on computer mark-sense forms, field notebooks or logged electronically on a computerized fish measuring board or hand held data logger. The original scale cards, acetates and data forms are archived at the ADF&G office in Anchorage.

Age is determined from the annuli of scales taken from the preferred area of the fish (INPFC 1963). The scales, which are mounted on gum cards, are impressed in cellulose acetate using methods described by Clutter and Whitesel (1956). The scale impressions are magnified with a microfiche reader and age is determined through visual identification of annuli. Ages are directly entered into the computer ASCII files using European notation.

*Methodology\_Citation:*

*Citation\_Information:*

*Originator:* Kohler, T. 2003

*Publication\_Date:* 2003

*Title:*

Norton Sound and Kotzebue Sound management area salmon catch and escapement report, 2002

*Series\_Information:*

*Series\_Name:* Regional Information Report

*Issue\_Identification:* 3A03-09

*Publication\_Information:*

*Publication\_Place:* Anchorage, Alaska

*Publisher:*

Alaska Department of Fish and Game, Division of Commercial Fisheries

*Other\_Citation\_Details:* Regional Information Report No. 3A03-09, Anchorage

*Methodology\_Citation:*

*Citation\_Information:*

*Originator:* Clutter, R. and Whitesel, L.

*Publication\_Date:* 1956

*Title:* Collection and Interpretation of sockeye salmon scales.

*Other\_Citation\_Details:*

Bulletin of the International North Pacific Fisheries Commission 9.

*Methodology\_Citation:*

*Citation\_Information:*

*Originator:* International North Pacific Fisheries Commission

*Publication\_Date:* 1963

*Title:* INFPC Annual Report, 1961

*Publication\_Information:*

*Publication\_Place:* British Columbia

*Process\_Step:*

*Process\_Description:* licked scales

*Cloud\_Cover:* 0

**Appendix A3.**—Excerpts from the Metadata record for escapement count data collected in the Norton Sound and Port Clarence area and included in the AYK salmon DBMS.

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## **NORTON SOUND AND PORT CLARENCE COHO SALMON ESCAPEMENT COUNT DATA**

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*Identification\_Information:*

*Citation:*

*Citation\_Information:*

*Originator:*

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

*Publication\_Date:* Unpublished Material

*Publication\_Time:* Unknown

*Title:*

Norton Sound and Port Clarence Area Coho Salmon Escapement Count Data

*Geospatial\_Data\_Presentation\_Form:* Database

*Description:*

*Abstract:*

This data set consists of daily counts or daily estimates of coho salmon (*Oncorhynchus kisutch*) in the Norton Sound and Port Clarence Area. Coho salmon were counted by observers stationed along freshwater migration corridors (primary, secondary or higher order streams). Coho salmon were 1) counted as they were allowed to pass upriver through weirs, and 2) counted as they migrated upriver past observers in elevated (towers) locations. Tower counts generally represent a sample and are expanded to represent a 24 h period. A number of projects (13) have collected counts since 1965 and represent total spawning populations in major spawning rivers draining into Norton Sound and Port Clarence. Location, daily count (or estimate), date collected, and count type (observed or estimated) are included in the data set.

*Purpose:*

Data were collected to estimate or document total spawning abundance; and estimate and document daily and seasonal timing of coho salmon migrating into the rivers of the Norton Sound and Port Clarence Area. Though ADF&G is the lead agency this data set includes all project and locations in the drainage conducted by federal agencies and non-governmental organizations.

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*Data\_Quality\_Information:*

*Logical\_Consistency\_Report:* Data is checked for logical errors when loaded

*Completeness\_Report:* Salmon were measured to the nearest 5mm

*Lineage:*

*Methodology:*

*Methodology\_Type:* Field

*Methodology\_Description:*

Counting location descriptions, methods and estimation of daily totals have been

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documented for each counting location and counting method (tower or weir) following routine procedures used by ADF&G. Reports can be found (example: Menard and Kent 2005) at <[http://www.sf.adfg.state.ak.us/statewide/divreports/html/dsp\\_Simple\\_Search.cfm](http://www.sf.adfg.state.ak.us/statewide/divreports/html/dsp_Simple_Search.cfm)>.

*Methodology\_Citation:*

*Citation\_Information:*

*Originator:* Menard, J. and S. Kent.

*Publication\_Date:* 2005

*Title:* Salmonid escapements at Kwiniuk, Niukluk and Nome Rivers, 2004

*Series\_Information:*

*Series\_Name:* Fishery Data Series

*Issue\_Identification:* No. 05-24

*Publication\_Information:*

*Publication\_Place:* Anchorage, Alaska

*Publisher:* Alaska Department of Fish and Game

*Other\_Citation\_Details:*

Alaska Department of Fish and Game, Fishery Data Series No. 05-24, Anchorage.

*Cloud\_Cover:* 0

**Appendix A4.**—Excerpts from the Metadata record for test fish data collected in the Norton Sound and Port Clarence area and included in the AYK salmon DBMS.

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## NORTON SOUND AND PORT CLARENCE CHUM SALMON TEST FISH DATA

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### *Identification\_Information:*

*Citation:*

*Citation\_Information:*

*Originator:*

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

*Publication\_Date:* Unpublished Material

*Publication\_Time:* Unknown

*Title:* Norton Sound and Port Clarence Area Chum Salmon Test Fish Data

*Geospatial\_Data\_Presentation\_Form:* Database

*Description:*

*Abstract:*

This data set consists of observations of chum salmon (*Oncorhynchus keta*) abundance and run timing collected with standardized gear and fishing procedures by ADF&G employees in the Unalakeet River. Daily Catch per unit effort (CPUE) data are stored as catch per hour along with hours fished, actual catch, gear type (set gillnet), gillnet mesh size, explicit location, and date. The Unalakeet test fish project has collected data since 1981 which is used to index adult salmon migrating into the river to spawn. Daily CPUE is also descriptive of migration timing and duration.

*Purpose:*

Data were collected to index abundance; and estimate and document daily and seasonal timing of chum salmon migrating into the Unalakeet River of the Norton Sound Area.

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### *Data\_Quality\_Information:*

*Logical\_Consistency\_Report:* Data is checked for logical errors when loaded

*Lineage:*

*Methodology:*

*Methodology\_Type:* Field

*Methodology\_Description:*

Fishing location descriptions, methods, and estimation of daily CPUE have been documented for the Unalakeet River following routine procedures used by ADF&G. Reports can be found (example: Kohler 2002).

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*Methodology\_Citation:*

*Citation\_Information:*

*Originator:* Kohler, T

*Publication\_Date:* 2002

*Title:* Unalakleet River test net project, 2001

*Series\_Information:*

*Series\_Name:* Regional Information Report

*Issue\_Identification:* No. 3A02-34

*Publication\_Information:*

*Publication\_Place:* Anchorage, Alaska

*Publisher:*

Alaska Department of Fish and Game, Division of Commercial Fisheries

*Process\_Step:*

*Process\_Description:* licked scales

*Cloud\_Cover:* 0