

Exxon Valdez Oil Spill
Restoration Project Annual Report

Cook Inlet Information Management and Monitoring System
Restoration Project 99391
Annual Report

This annual report has been prepared for peer review as part of the *Exxon Valdez* Oil Spill Trustee Council restoration program for the purpose of assessing project progress. Peer review comments have not been addressed in this annual report.

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Exxon Valdez Oil Spill

Cook Inlet Information Management and Monitoring System

Restoration Project 99391 Annual Report

Study History: This project was initiated in 1999 as the Cook Inlet Information Management and Monitoring System submitted jointly by the Alaska Department of Environmental Conservation and the Alaska Department of Natural Resources. During 1999 work focused on identifying appropriate data sets pertaining to Cook Inlet, conducting a user needs analysis, and developing a Prototype application. The project was approved in August 1998 on a limited scale, designed to facilitate a data inventory and the a user needs analysis. The results of the user needs analysis and data inventory effort were reviewed by the Trustee Council in March 1999 and authorization was received for development of a content-limited fully functional prototype, focusing on the Kenai River watershed.

Abstract: The Cook Inlet Information Management/Monitoring System (CIIMMS) provides an interactive website that links to a geographically distributed system of information providers. Through the CIIMMS website, users are able to identify and access (e.g., download and/or print) information ranging from primary data (geospatial and tabular) to reports, project descriptions, and other documents across a variety of themes, such as habitat, land use, resource management, pollution, and water-quality information. CIIMMS will also provide (on-line) tools to make it easy to contribute information to the CIIMMS network. In the long term, CIIMMS will use integrated information resources and tools to create a virtual community center for Cook Inlet learning, resource management, and related activities.

CIIMMS not only comprises the hardware, software, and information contact components of the Cook Inlet information management system, it also establishes a framework for managing information resources more efficiently. Two important components of CIIMMS development are (1) establish an advisory group made up of data providers and users to oversee long-term implementation and (2) publish guidelines on how to implement various aspects of the framework (e.g., compile metadata). The CIIMMS tools and framework to enable a unified approach to information management in the watershed will help agencies and organizations use existing resources more effectively.

Key Words: Information Management, CIIMMS, website, Cook Inlet, Resource management, Natural Resource management, clearinghouse, data clearinghouse, World Wide Web, Web

Project Data: Information is available on line at <http://www.dec.state.ak.us/ciimms>.

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EXECUTIVE SUMMARY

The Cook Inlet Information Management/Monitoring System (CIIMMS), Project 99391 was funded in FY 99 to conduct a user needs analysis and develop a prototype system as an evaluation tool useful for development of a final set of system specifications. Deliverables associated with the FY99 effort include:

1. User Needs Analysis – completed February 28, 1999.
2. Identification and Preliminary Prioritization of Datasets – completed February 1999.
3. Prototype – completion date, September 30, 1999.
4. Preliminary System Specifications - completion date, February 28, 2000.

To ensure CIIMMS is a valuable tool for a diverse community of information users and providers, the CIIMMS Project Team conducted an extensive User needs analysis that included:

- Compiling a database of probable users and/or information suppliers.
- Distributing a comprehensive 60-question survey to all contacts in the database, compiling and analyzing the results.
- Conducting project briefings and discussion groups in communities and organizations in the watershed.
- Conducting follow-up interviews with various survey respondents and participants.

The investigations of the User needs analysis covered the following topics:

- Inventory of products and/or output generated.
- Future activities
- Information/data description
- Information processing
- Vision or wish list for information management
- Inventory of software, hardware, and telecommunications capabilities

Information gained from these investigations was provided to participants at a User Needs Workshop held in January of 1999. Over 100 people attended the workshop to validate survey results (over 70 surveys were returned) and address the following design questions:

- What questions should CIIMMS address?
- Which users should CIIMMS accommodate?
- What information should be included in CIIMMS?
- What should CIIMMS accomplish (system functions)?
- What products should CIIMMS be able to generate?
- What system design should CIIMMS adopt?
- How can we make CIIMMS happen?
- What kind of user interface should CIIMMS have?
- What information should be included in CIIMMS?

The results of this extensive user needs analysis formed the basis for a pilot phase implementation plan, completed May 18, 1999. The implementation of the pilot phase focuses on short term priorities identified in the User needs analysis process in a limited geographic area, the Kenai River watershed (Appendix A: "The CIIMMS Prototype: Sample Web Pages"). Results of the user survey and workshop, presented in *CIIMMS Requirements & Recommendations*, as well as the detailed *Pilot Phase Implementation Plan* can be found on the CIIMMS web site at <http://www.dec.state.ak.us/ciimms> (see the *About CIIMMS* link).

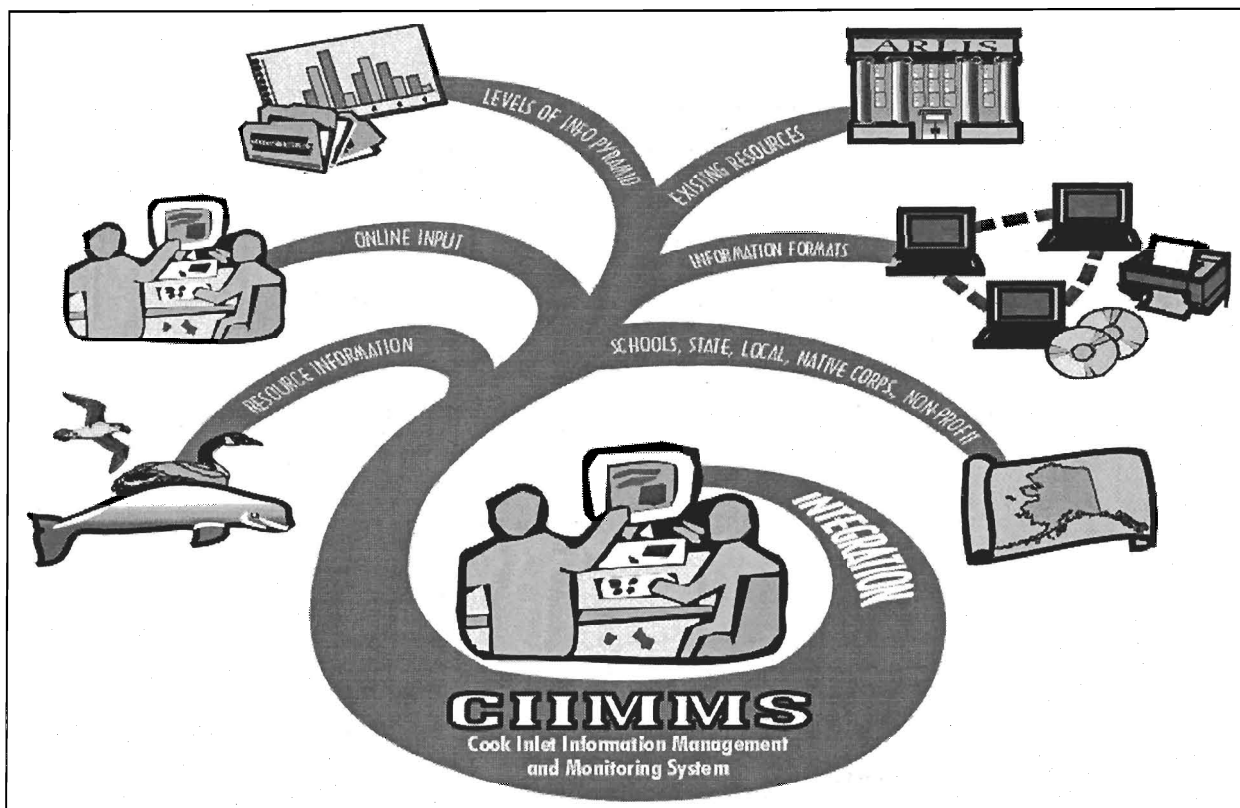
CIIMMS will mature into a geographically distributed decision support system with tools for data visualization and analysis and information synthesis. CIIMMS will provide a framework for collaboration, access to and sharing of data. As an information resource, providing access to both current and historical data and information, CIIMMS can contribute to the success of many future projects within the spill area including the Gulf Ecosystem Monitoring project being funded with the Restoration Reserve.

INTRODUCTION

The CIIMMS is a three-year project, funded by the *Exxon Valdez* Oil Spill Trustee Council, which will deliver a website with tools for accessing, contributing and sharing of information for the Cook Inlet watershed. This site and its associated graphical user interface will support monitoring, management and restoration of resources and services injured by the *Exxon Valdez* Oil Spill, as well as provide access to data sets and tools valuable to addressing the ecological health of a watershed. This system is unique in that it will provide access to a broad spectrum of timely data and visualization tools via the Internet. CIIMMS will allow regulators, resource managers, planners, and others to approach decision-making from a watershed perspective.

The vision for CIIMMS is to develop a comprehensive information system based on the latest Internet technologies that will enable a wide range of users to contribute, identify, share, and access valuable information about the Cook Inlet watershed and Cook Inlet related activities. This vision was established after extensive background investigations and culminated in a 2-day user needs workshop held in Anchorage, Alaska, on January 26-27, 1999. Two reports (SAIC 1999a and 1999b) describe the results of the background investigations and workshop outcomes.

FIGURE 1: CIIMMS CONCEPTUAL DESIGN STRUCTURE.



OBJECTIVES

The CIIMMS' objective is to provide a way for the Cook Inlet community (resource managers, scientists and researchers, educators, students, industry, and individual citizens) to identify, share and access, and contribute (on-line) valuable knowledge, information, and data about the Cook Inlet watershed from a distributed network of data resources and information providers.

METHODS

At the time the Alaska Department of Natural Resources (ADNR) and the Alaska Department of Environmental Conservation (ADEC) launched the CIIMMS project, a multi-agency project team was formed. The team presently includes members from U.S. Environmental Protection Agency, the U.S. Forest Service, the U.S. Geologic Survey, and the ARLIS Library (Alaska Resources Library and Information Services). Science Applications International Corporation (SAIC) continues to provide technical guidance and support to the CIIMMS team.

CIIMMS' implementation is occurring in three phases:

Phase I: The Pilot Phase, generating a functional prototype (completed December 1999);
Phase II: Initial Production Phase (January 2000 - April 2001) ; and
Phase III: Final Implementation Phase (Years 3 through 5).

Phase I: The CIIMMS Prototype

CIIMMS' Phase I encompassed the following activities:

- Assessment of user needs through surveys, focus groups, and a 100-person stakeholder workshop, which also evaluated current information management approaches within the Cook Inlet community.
- Development of the "Cook Inlet Information Management Requirements and Recommendations" post-workshop report (available online at <http://www.dec.state.ak.us/ciimms/> (see *About CIIMMS* link). More than 100 Cook Inlet stakeholders contributed directly to this document's evaluation of CIIMMS priority information, functions, system design, and user interface.
- Design and implementation plan for the CIIMMS prototype (accessible online at <http://www.dec.state.ak.us/ciimms/>). To view the "Pilot Phase Implementation Plan" document, see the *About CIIMMS* link.

The Phase I deliverable was the CIIMMS prototype website. The site acts as a clearinghouse node for searching and reviewing Cook Inlet related metadata (i.e., an electronic card catalog that characterizes specific Cook Inlet information resources). Metadata records characterize data sets and project descriptions, and a web crawler provides a fast index to Cook Inlet related web sites. CIIMMS provides a common interface for searching through bibliographic metadata, geospatial metadata, and keyword-based metadata on the CIIMMS server and other Internet-linked information servers. CIIMMS-accessible servers include Alaska's geospatial clearinghouses; state and local libraries; local, state and federal agencies' websites; non-governmental websites, such as those of local newspapers, research centers, and citizens' groups.

Wherever possible, metadata records contain hyperlinks to the information resources that they characterize. Such resources will include spatial and tabular data, maps, project descriptions, technical reports, organizational points of contact, and other useful documents. Specific information include ecosystem assessment data, land ownership maps, government reports on contaminated sites, or descriptions of salmon restoration projects. Once accessed, the information can be viewed, downloaded, and printed by the user.

Evaluation criteria were developed for the CIIMMS prototype, and these criteria were used to build evaluation forms, which were handed out (and filled out by evaluators) at all the CIIMMS outreach and demonstration workshops. To allow evaluators to provide feedback while accessing the site, some simple, straight-forward entry forms were provided on-line, to

collect more spontaneous feedback. General evaluation criteria included ease of use, response time, usefulness of information, visual appearance, and other appropriate criteria.

This approach provided for rapid collection of reviewer feedback during the Pilot Phase. User feedback and reviewer comments were used to build the specifications for the Initial Production Phase.

The prototype area of interest, CIIMMS home page and functionality delivered by the CIIMMS Pilot Phase is shown in Figures 2, 3 and 4 respectively.

FIGURE 2: MAP OF THE COOK INLET BASIN AND CIIMMS PROTOTYPE STUDY AREA (KENAI RIVER WATERSHED).



FIGURE 3: CIIMMS PROTOTYPE WEBSITE HOMEPAGE.

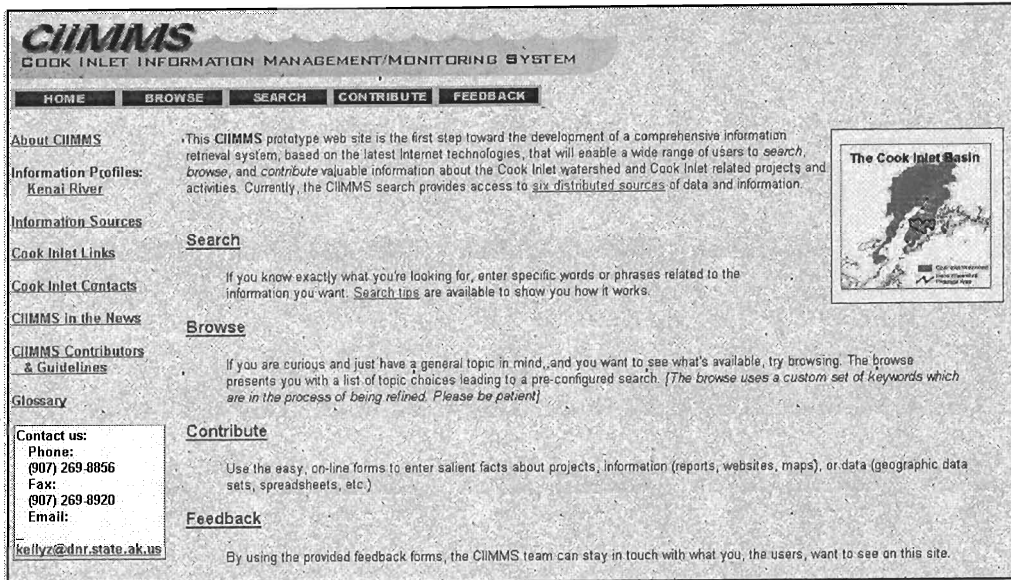


FIGURE 4: DESIGN SUMMARY FOR CIIMMS PROTOTYPE

Geographic Scope	Kenai River Watershed
Information Types	Anadromous streams/species, wetlands, ground water well logs, EVOS data, etc.
Information Sources	ADEC, ADF&G, ADNR, Kenai Peninsula Borough Planning Department, USGS, and others
Functions	Search , browse, on-line metadata entry capability
Information Features	
-- Identifying	<ul style="list-style-type: none"> • Categorical indexes for Cook Inlet information inventory • Keyword and advanced metadata searching • Restoration project activities
-- Accessing	<ul style="list-style-type: none"> • Ability to view, download, and print static maps and web documents • Metadata records linked to actual data and summary information • Hotlist of all related offsite links
-- Contributing	<ul style="list-style-type: none"> • Form for suggesting information and links to add to clearinghouse • Metadata entry tool for data/projects (short form) to populate clearinghouse
Evaluation Tools	<ul style="list-style-type: none"> • Feedback forms online

Phase II: Initial Production Phase

The pilot phase has been completed and an operational prototype has been developed. The initial production phase (FY 2000) will include expansion of access to knowledge, information, and data, including *traditional ecological knowledge*, building on the datasets available via the prototype. Information accessible via CIIMMS includes on-going projects taking place within the basin. The search capabilities will be refined to include a map-based and advanced, fielded search tools, and refinement of the interface will build upon the browse and metadata entry tools delivered during Phase I. Coordination and outreach will continue to be a vital part of CIIMMS, using the CIIMMS Advisory Group as the primary vehicle.

Phase III: Final Implementation Phase

In the long term, CIIMMS will use integrated information resources and tools to create a virtual community center for Cook Inlet learning, resource management, and related activities. Throughout its development, CIIMMS aims to remain user-driven. CIIMMS will continue to enable users to submit evaluations and recommendations regarding products and services, to ensure that the tools and resources continually meet the evolving needs of the Cook Inlet community.

CIIMMS cannot be realized overnight. As people benefit from CIIMMS, the incentive to contribute to CIIMMS will increase. Agencies will realize cost savings associated with the dissemination of information and distribution of data as more information and data is made available through CIIMMS. CIIMMS will provide a valuable tool for past and future EVOS funded efforts by providing access to data and information related to EVOS funded projects as well as providing a nexus for future research and restoration collaborations.

DISCUSSION

Prototype Functionality

Search Tools

CIIMMS will provide users three mechanisms to actively search for information resources. These include a basic keyword search, an advanced search for terms in specific fields, and a map-based search for information within specific geographic boundaries.

The results of two-term Boolean search currently found on the prototype interface are shown in figure 5. In order for the CIIMMS search to locate data and information, metadata must exist for that resource. Metadata in this context can be any reference made to the data or information that is accessible via CIIMMS. The reference to the information could "live" in any of the following locations (see figure 6):

- CIIMMS Local Database
- CIIMMS Project Database
- Web pages
- ARLIS or any other bibliographic catalog which is accessible via Z39.50 protocol
- Alaska Geospatial Data Clearinghouse
- Alaska State Geospatial Data Clearinghouse
- Municipality of Anchorage Geospatial Data Clearinghouse

Browse Tools

An alternative to the CIIMMS search will be the CIIMMS browse tree. A browse tree is a set of hierarchically organized lists of terms that provide a semantic guide for finding information resources according to theme or subject, geographical location, or information provider or originator. CIIMMS will have two browse trees, one organized by subject, and one by originator. The browse will present the user with a list of selections. Based on what is selected the user will be presented with another list. The lists will be collapsible and eventually will lead to a category that returns a list of results. As the data accessed by CIIMMS is expanded, the number of browse levels will be expanded in order to keep the number of results returned to the user manageable.

Contribute Tools

The Contribute functionality is the key to the long-term sustainability of CIIMMS because it will provide the Cook Inlet stakeholders with the necessary tools for keeping CIIMMS up-to-date. "Contribute" will provide the following tools to users:

- a) step-by-step instructions, in the form of a tutorial, to assist users in making their data/information accessible via CIIMMS, for first-time contributors;
- b) CIIMMS Contributor Guidelines, an on-line publication of technical specifications for advanced contributors
- c) direct links to all on-line metadata entry forms and upload tools, for repeat customers.

FIGURE 5: EXAMPLE RESULTS FROM CIIMMS SEARCH.

The figure displays three screenshots of the CIIMMS (Cook Inlet Information Management/Monitoring System) search interface. The top-left screenshot shows the search process with the query 'salmon' and 'AND' filter. The top-right screenshot shows search results for 'salmon' with a table of results and a detailed abstract for a project on sockeye salmon restoration. The bottom-left screenshot shows search results for 'Anadromous Streams - KBEC Database' with a list of metadata items. The bottom-right screenshot shows the detailed metadata for the selected database.

Search Results Table (Top-Right Screenshot):

Database	Status	Result Count
CIIMMS Local Database	Search Successful	1
CIIMMS Project Database	Search Successful	57
WorldCat (bibliographic Resources, Text, etc.)	Search Successful	3
ASGDC (Alaska State Geospatial Data Clearinghouse)	Search Successful	1
ASGDC (Alaska Geospatial Data Clearinghouse)	Search Successful	10
CIIMMS Web Harvest	Search Successful	976
AK State Library	Search Successful	2246

Search Results Table (Bottom-Left Screenshot):

Database	Status	Result Count
CIIMMS Local Database	Search Successful	1
CIIMMS Project Database	Search Successful	57
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ASGDC (Alaska Geospatial Data Clearinghouse)	Search Successful	10
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AK State Library	Search Successful	2246

Search Results Table (Bottom-Right Screenshot):

Database	Status	Result Count
CIIMMS Local Database	Search Successful	1
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WorldCat (bibliographic Resources, Text, etc.)	Search Successful	3
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ASGDC (Alaska Geospatial Data Clearinghouse)	Search Successful	10
CIIMMS Web Harvest	Search Successful	976
AK State Library	Search Successful	2246

Abstract (Top-Right Screenshot):

Effect of Oil Incubation Substrate on Straying and Survival of Wild Pink Salmon Project No. 99076, Project Year: 1998; Publication Date: 1999
Abstract: This project examines the effects of oil exposure during embryonic development on the straying, marine survival, and gamete viability of pink salmon. The objectives are to conduct a related series of controlled experiments on straying of pink salmon to determine the role of oil and other factors so that field studies of straying in Prince William Sound after the oil spill can be interpreted, to determine if the return rate of pink salmon to adult is reduced when they have been exposed to oiled gravel during embryonic development, and to continue investigations into whether such exposure causes heritable damage to reproductive fitness of pink salmon.

Kenai River Sockeye Salmon Restoration Project No. 14255, Project Year: 1994; Publication Date: 1994
Abstract: Greatly reduced fishing time in the Upper Cook Inlet (UCI) area due to EVOS caused sockeye salmon spawning escapement levels in the Kenai River system to exceed the desired amount by three times. Data collected by the Natural Resources Damage Assessment following the EVOS indicated greatly reduced survival of juvenile sockeye salmon during the winter-spring rearing period. Overpopulated rearing juvenile sockeye salmon may have exceeded the carrying capacity of salmon rearing lakes, affecting all trophic levels in the lakes. Limiting sockeye salmon fry production by closely regulating the number of spawning adults may be the only way to restore the productivity of these rearing areas. The goal of this project is to restore Kenai River sockeye salmon stocks injured by the EVOS through improved stock assessment capabilities, more accurate regulation of spawning levels, and modification of human use-Kenai River System sockeye salmon will be identified by Genetic.

Kenai River Sockeye Salmon Restoration Project No. 13633, Project Year: 1992; Publication Date: 1992
Abstract: Sockeye salmon (*Oncorhynchus nerka*) which spawn in the Kenai River system were injured by the Exxon Valdez oil spill. Greatly reduced fishing time in the Upper Cook Inlet area due to the oil spill caused sockeye salmon spawning escapement levels in the Kenai River system to exceed the desired amount by three times. The biological impact of the oil spill on Kenai River sockeye salmon stocks is expected to be serious. Data collected by NRDA Fish/Shellfish Study 27, Sockeye Salmon Overescapement, indicated greatly reduced survival of juvenile sockeye salmon during the winter-spring rearing period. The extremely high escapement may have initially produced more rearing juvenile sockeye salmon than could be supported by nursery lake productivity. In general, when rearing salmon abundance greatly exceeds lake carrying capacity, the species and size composition of prey resources are altered, which affects all trophic levels. Because of such changes, juvenile sockeye growth is reduced.

Title: Alaska Fish and Game ?Pacific Salmon Treaty
Author: Maria Trollan **Date:** Thu, 15 Apr 1999 01:32:32 GMT
 Atlantic Salmon-A White Paper Northern Boundary Coho Runs Strong - Forecast of Coho "Crisis" Not Supported by Inseason Data Status of Coho Salmon Stocks and Fisheries Alaska's Salmon Management Canada's Perspective on Pacific Salmon: Long on Rhetoric, Short on Facts Pacific Salmon Treaty Coalition Members Marine Factors in the Production of Salmon: Their Significance to the Pacific Salmon Treaty ?PDF file (68K) Some of these files are formatted in Portable Document Format (PDF) and require a Pacific Salmon Treaty information.

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Title: AD&G - Commercial Fisheries: 1999 Lower Cook Inlet Salmon Fishery Forecast
Author: LCI Salmon Staff / Tim Baker **Date:** Thu, 04 Nov 1999 15:30:39 GMT
 CENTRAL REGION: Home - Search - Contact Us 1998 Lower Cook Inlet Commercial Salmon Fishery Forecast 1999 Harvest Forecast Species Enhanced Natural Total Chinook Salmon a 1,300 a Sockeye Salmon 312,000 c 87,700 b 999,700 Coho Salmon a 14,800 a Pink Salmon 3,062,000 c 726,500 3,788,500 Chum Salmon 0 10,400 b 10,400 Total 3,374,000 824,800 4,214,700 a Commercial harvest forecasts of chinook and coho salmon represent average harvests since 1980 a Updated information pertaining to the 1999 Lower Cook Inlet Salmon fishery forecast, Alaska.

Metadata (Bottom-Right Screenshot):


Identification Information:

- Identification Information
- Data Quality Information
- Spatial Data Organization Information
- Spatial Reference Information
- Entity and Attribute Information
- Distribution Information
- Metadata Reference Information

Citation Information:


Originator: Alaska Department of Fish and Game
Publication Date: 1998
Title: Anadromous Streams - KBEC Database
Geospatial Data Presentation Form: Map
Publication Place: Anchorage, AK

FIGURE 6: CIIMMS METADATA SOURCES.

 **CIIMMS Local Database**


This database is internal to CIIMMS, and right now, contains the Data Inventory that the CIIMMS Project Team produced as part of the User Analysis Phase of CIIMMS. It only houses references to data not found at other clearinghouses (!). CIIMMS metadata structure is flexible enough to include both EGDC-compliant and non-compliant records.

*If you'd like to enter information about data that you would like to make 'discoverable' via CIIMMS, you too can **contribute to CIIMMS** using an on-line data entry form.*

 **CIIMMS Project Database**


The CIIMMS team has generated this unique database to store information on resource management projects across the Cook Inlet basin. Projects taking place in the Kenai River watershed of Cook Inlet are already being included, with those from other locations to follow soon.


*To enter information about a particular project within the Cook Inlet basin, please feel free to **contribute to CIIMMS** via the on-line data entry form.*

 **WorldCat (Bibliographic Resources)**


The WorldCat™ database, a.k.a., the OCLC Online Union Catalog, contains more than 39 million records describing items owned by libraries around the world – including ARLIS, the Alaska Resources Library and Information Services. Every record in WorldCat™ describes a holding at one or more of these libraries. WorldCat™ will be replaced by ARLIS as soon as the ARLIS server is up and running (mid-November, 1999)

WorldCat™ helps users identify library materials (as opposed to metadata, spatial data, or web resources). For each material, a WorldCat record can provide information on its author(s), title, publication, series information, subject headings, notes, call numbers, languages, geographic location, or other elements selected by the CIIMMS Project Team

 **ASGDC (Alaska State Geospatial Data Clearinghouse)**

 **AGDC (Alaska Geospatial Data Clearinghouse)**

The ASGDC and the AGDC are part of a growing clearinghouse infrastructure that give Internet users access to search against (EGDC-compliant) geographic metadata databases nationwide. The AGDC uses the same clearinghouse search software as CIIMMS, but targets a more technical audience, and those familiar with the analysis and manipulation of geographically referenced datasets. The CIIMMS project includes these two clearinghouse nodes in its search in order to deliver a 'comprehensive' accounting of all the data and information available on a given topic. As of October 1999, the CIIMMS search engine queries only the theme keywords section of the metadata records.

 **CIIMMS Web Harvest**

The CIIMMS web harvest is a database of web resources, collected weekly by CIIMMS database administrator, using Blue Angel Harvester software. The harvest focuses on collecting information from specific sites and pages, using customized software, so that the user gets more relevant results, or hits, from a search. The Harvester is currently being tested with a Cook Inlet-specific set of web addresses (URLs) to search.

System Architecture

In order to accomplish the system functionality prioritized at the CIIMMS user needs workshop, the system architecture was designed and implemented as follows:

- A client-server architecture was implemented, based on an Internet browser (i.e., a thin client)
- The data and information is served in a hybrid environment — both centralized and distributed. For example, during the pilot phase, a centralized server was provided for metadata, summarized data, and some primary data, with links established to distributed servers for sources of the majority of primary data.

The CIIMMS Project Team evaluated several options in developing the CIIMMS system architecture. These included the Chesapeake Bay system design (specifically, its metadata entry tool), the Federal Geographic Data Committee (FGDC) clearinghouse design, and several commercial-off-the-shelf (COTS) products (Compusult Metamanager, Blue Angel Technology). The Team decided to base the architecture on a COTS solution. A COTS solution has the advantage of providing the team with access to software upgrades, as technology changes, and access to a vendor-supplied “Help Desk” for aiding the CIIMMS administrator with system maintenance. A COTS solution would also ‘free’ the Project Team from being dependent on a technical contractor once development was complete.

Based on its evaluation, the Team selected the COTS software solution, MetaStar Enterprise, developed by Blue Angel Technologies for the CIIMMS Prototype system architecture. MetaStar Enterprise integrates database, search engine, and web technologies in a single solution that provides for the search and discovery of metadata and information via the Internet. Enterprise is a bundle of the MetaStar Data Entry, Repository, Gateway, and Server components. The architecture also includes the Metaharvester, which is a software robot that gathers selected information from designated websites. This tool gathers and parses XML and HTML, extracting designated elements such as HTML tags and META tags (e.g., title, body, meta, etc.). The robot will allow CIIMMS to include web-page information in its metadata database and search engine.

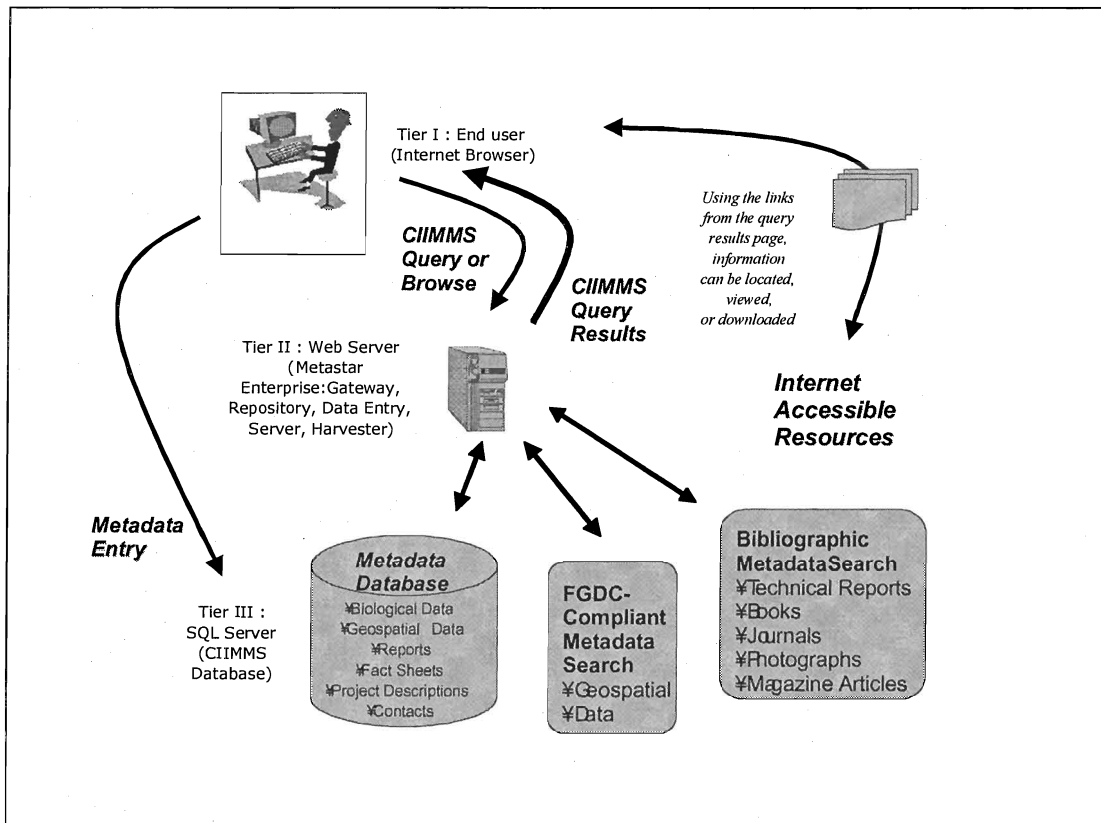
Figure 7 shows a high-level schematic of the prototype system architecture. The system is structured into three tiers, as follows:

- Tier I: End user machine with an Internet browser, such as Netscape or Internet Explorer
- Tier II: Web Server, which houses the MetaStar Enterprise software for discovering and accessing metadata and information from multiple sources.
- Tier III: SQL Server, which houses the CIIMMS metadata and projects database.

Identifying and accessing metadata and information will be accomplished by using the Z39.50 standard client-server protocol for information retrieval and for focused web crawling of non-Z39.50 sites that contain web pages and hypertext relevant to Cook Inlet. A map-based query tool will be provided to facilitate the search and discovery of metadata. The system architecture also will provide for online linkages to the data and information through data downloads (via ftp), document viewing via portable document formats (PDF) files, and image viewing through standard formats, such as graphics interchange format (GIF) files.

The CIIMMS system utilizes a hybrid centralized/distributed design, meaning that some CIIMMS metadata and information resources will be housed on the (centralized) CIIMMS server, while other resources will be housed on servers located elsewhere (e.g., at different agencies) throughout the watershed. Metadata collected using the CIIMMS on line contribution tools will be centralized, on the CIIMMS server. However, data housed on CIIMMS in the early stages will eventually be migrated toward a more distributed design. CIIMMS aims to help agencies and organizations become more successful at providing access to their own data and information using emerging web technologies, by providing web-published guidelines and technical support. This type of guidance and support will enable migration toward a more distributive system. To test the distributive concept, a few distributed sites are currently accessible via CIIMMS. These pioneer sites will provide lessons learned and expertise to organizations interested in providing data and information access via CIIMMS.

FIGURE 7: CIIMMS HIGH-LEVEL SYSTEM ARCHITECTURE.



CONCLUSIONS

The process of accessing information and building a distributed network of data and information providers, via the web, is iterative. The speed with which technology is advancing, and the building of interest from multiple sectors, necessitates the use of adaptive management practices to achieve potentially sliding targets. As the CIIMMS project has evolved, the Team has narrowed the scope to address specific needs of Cook Inlet users, related to data and information access and discovery, as opposed to the actual integration of data, which relies heavily on data standards.

Achieving the CIIMMS vision will require the cooperation of many entities. The project team will provide coordination, outreach, and user training to CIIMMS contributors in order to help build links necessary for success. The CIIMMS Advisory Group, made up of a broad group of data providers and stakeholders, will ensure that there is a bridge between technical, management, and end-user concerns. This group will help ensure that the system will remain usable in the future.

Technical roadblocks are small compared to cooperation and coordination issues. Data dissemination by agencies on a broad scale is happening more slowly than was perceived at the beginning of the project, but CIIMMS is uniquely situated to assist with associated issues as they emerge within the data community. Consistent approaches towards data dissemination will facilitate data integration in the future, as more and more organizations make their data available. The CIIMMS team continues to assist information providers with public access (especially EVOS-funded) via CIIMMS, and is committed to providing agencies and organizations with viable options, considerations, and tools necessary for creating a central resource for decision-making within the Cook Inlet.

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