California Pilot of EFCL Electronic Fish Ticketing: A Case Study and Preliminary Systems Analysis

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Dr. Richard Methot

NOAA Fisheries

Chaliese Poset

Sabre Systems, Inc.

Gerry J. Kobylinski

California Department of Fish and Game,
Technical Services Branch

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1 INTRODUCTION

1.1 Background, Purpose and Scope

A growing number of fisheries agencies are transitioning from paper to electronic means of collecting fisheries dependent data, with the expectation that data can be collected, validated and reported with improved ease, accuracy and timeliness, thereby increasing its value for fisheries management.

The Northwest Fisheries Science Center (NWFSC), in coordination with a private-sector partner, developed the prototype Electronic Fish Catch Logbook (EFCL) to demonstrate the feasibility and value of a highly integrated fishery data collection system. The system includes ship-based software, a shore-based web application and a database which collect and systematically integrate data from commercial vessel logbooks, landing receipts (fish tickets), species composition and biological sampling activities.

In October of 2003, the California Department of Fish and Game (CDFG), in a cooperative effort with NWFSC, pilot tested one portion of EFCL – its web-based fish ticketing features – to determine whether EFCL might be an appropriate solution for electronic dealer ticketing in California.

EFCL was configured for the California fishery environment and put into a period of use at one fisher dealer plant as a case study. Observations from the case study were carried forward into a more detailed evaluation of the system in the context of state level needs, operations, technical and regulatory considerations.

This document summarizes the results of the EFCL California pilot and systems evaluation. While the information presented here is specific to EFCL, we expect that many observations or lessons may be broadly applicable to the consideration of any electronic ticketing system.

1.2 About This Document

This document is appropriate for anyone with a stake in electronic dealer ticketing or e-reporting and an interest in the processes, constraints and technologies currently involved, particularly with respect to the California fisheries environment.

- **Section 2** acknowledges pilot participants and major contributors to this document.

- **Section 3** summarizes the type, purpose and sequence of activities used to conduct the pilot.

- **Sections 4, 5 and 6** present overviews of CDFG and dealer landing receipt processes and the EFCL system, respectively. This background information frames the evaluation found in section 7.

- **Section 7** evaluates EFCL's suitability for California e-ticketing on the basis of features, technologies, and alignment with prevalent operations and regulations.

- **Section 8** presents final conclusions drawn from the CDFG EFCL pilot.

A number of terms are used interchangeably in this document: *landing receipts* and *fish tickets*; *electronic* and "*e-*"; *fish dealer* and *processor*; *screen, page, window,* and *interface*. Also, "*e-reporting*" is used to describe, in the broadest sense, any electronic submission of data to management agencies, while *reports* and *reporting* typically refer to system features which produce output, on-screen or on paper.

2 ACKNOWLEDGEMENTS

3 APPROACH AND METHODS

The California EFCL pilot was conducted part-time over a period of approximately six months, from October 2003 to March 2004. The project team employed a variety of testing and system evaluation techniques.

Functional Testing and Usability Inspection – To begin the pilot, the pilot Project Manager performed functional testing[1] and one form of usability inspection[2] to become familiar with EFCL's fish ticketing features and uncover any issues which should be addressed through fixes, documentation or training. Fixes were minimal and are not presented as part of systems evaluation; usability issues are, particularly those reinforced by dealer and fishery technician users during case study acceptance testing.

CDFG Acceptance Testing and System Configuration – Acceptance testing began as reference data was loaded and the CDFG Project Lead tested EFCL's user interfaces, unscripted, generating Requests for Change (RFCs) to adapt the system to California's dealer ticketing environment. RFCs were prioritized according to criticality and cost or feasibility and the system was modified to satisfy most of them without substantially altering the basic EFCL structure.

User Training, User Testing – After initial system configuration, fish dealer data entry personnel were trained in person. This training is more aptly described as user testing, whereby participants where asked to use the system, observed but uncoached, and voice their thoughts throughout the process. NWFSC and CDFG leads observed the entry of a trawl ticket, assisting dealer personnel only when necessary. About 60-70% of total dealer feedback came from this 1.5 hour discussion. RFCs were again prioritized, with the majority implemented immediately and a few (such as for reporting needs and data exports) addressed later in the case study.

Dealer Case Study Acceptance Testing – Once the bulk of dealer system configuration was complete, case study acceptance testing[3] began. The case study took approximately 3 months due to business demands on dealer participants and the pilot's timing (spanning the winter holiday season). Actual ticket entry required only a few hours in two to four individual sessions. Dealers entered approximately 50 tickets. While this cannot be considered a comprehensive test, it was more than enough to identify the most common dealer issues and move on.

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[1] Functional testing determines whether a system performs against documented functional requirements.

[2] The form of usability inspection employed was *heuristic evaluation*. This is a low-cost technique which permits someone with or without in-depth subject knowledge of a system to evaluate user interfaces against several industry-recognized heuristics (or principles) of usability. The definition of the 10 "global" heuristics applied (including error prevention and recovery, flexibility and efficiency of use, consistency and standards, and more) can be found at: http://www.useit.com/papers/heuristic/. Additional principles can be found at: http://www.asktog.com/basics/firstPrinciples.html. Definition of other usability inspection methods can be found at:

Neilsen, J. and R. L. Mack, 1994, Usability Inspection Methods, John Wiley & Sons, New York, NY, 1994. ISBN 0-471-01877-5 (hardcover).

[3] Acceptance testing determines whether a system delivers its functionality in a way that suits users, such that they would accept the system for production use.

The case study continued as the fisheries technician and project leads used the system to review, correct, and track tickets and examined administrative functionality.

Systems Analysis – Once the case study data entry closed, dealer personnel provided feedback. Drawing on that feedback and their own experience, project leads attempted to determine which results and assumptions might apply to the California dealer ticketing environment as a whole. We examined prevalent operations, regulations and needs, as well as EFCL back-end system technologies, implementation and system support issues. Due to the limited pilot scale and scope, this is best described as a *preliminary* needs and systems analysis. Analysis included a cursory survey of other e-ticketing initiatives. In conclusion, the results of all prior stages were examined on a topic-by-topic basis.

4 OVERVIEW OF CDFG DATA COLLECTION PROCEDURES

4.1 Data Collection and Validation Processes

The bulk of California's fishery data collection and validation processes are centered around commercial groundfish species.

Figure 1, updated from its 1997 source[4], provides a flow diagram of the processing of data from 4 commercial sources: trawl logbooks, transportation receipts, party boat receipts and landing receipts. Figure 1's flow diagram begins with paper records in CDFG custody.

Figure 2 provides a summary flow of the processing of only landing receipts (the focus of the pilot), beginning with paper records in *dealers'* custody. Figure 2 is followed by a step-by-step explanation of ticket processing, with emphasis on the hand-offs of ticket custody (and any data manipulation) from dealer to port marine unit to central CDFG processing. Each one of these steps has the potential to be significantly altered with the introduction of an e-ticketing system.

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[4] Sampson, D.B., and P.R. Crone. 1997. Commercial fisheries data collection procedures for U.S. Pacific coast groundfish. NOAA Tech. Memo. NMFS-NWFSC-31, 189 p.

Trawl Logbook Processing

Marine units receive copies by 10th of month, edit

Keyed or mailed to Los Alamitos

Transportation Receipt Processing

Los Alamitos receives copies by 16th & end of month

Key data entry

Party Boat Receipt Processing

Los Alamitos receives copies by 10th of month

Sort and batch receipts

Scan or key receipts, edit

Landing Receipt Processing

Marine units receive copies by 16th & end of month, edit

Mailed to Los Alamitos

Pre-Production Database Sacramento

Produce transaction report

Bundled landing receipts

Manually examine landing receipts on report

Key data corrections

Produce corrected transaction report

Manual verification and key entry of corrections, as needed

Production Database, Sacramento

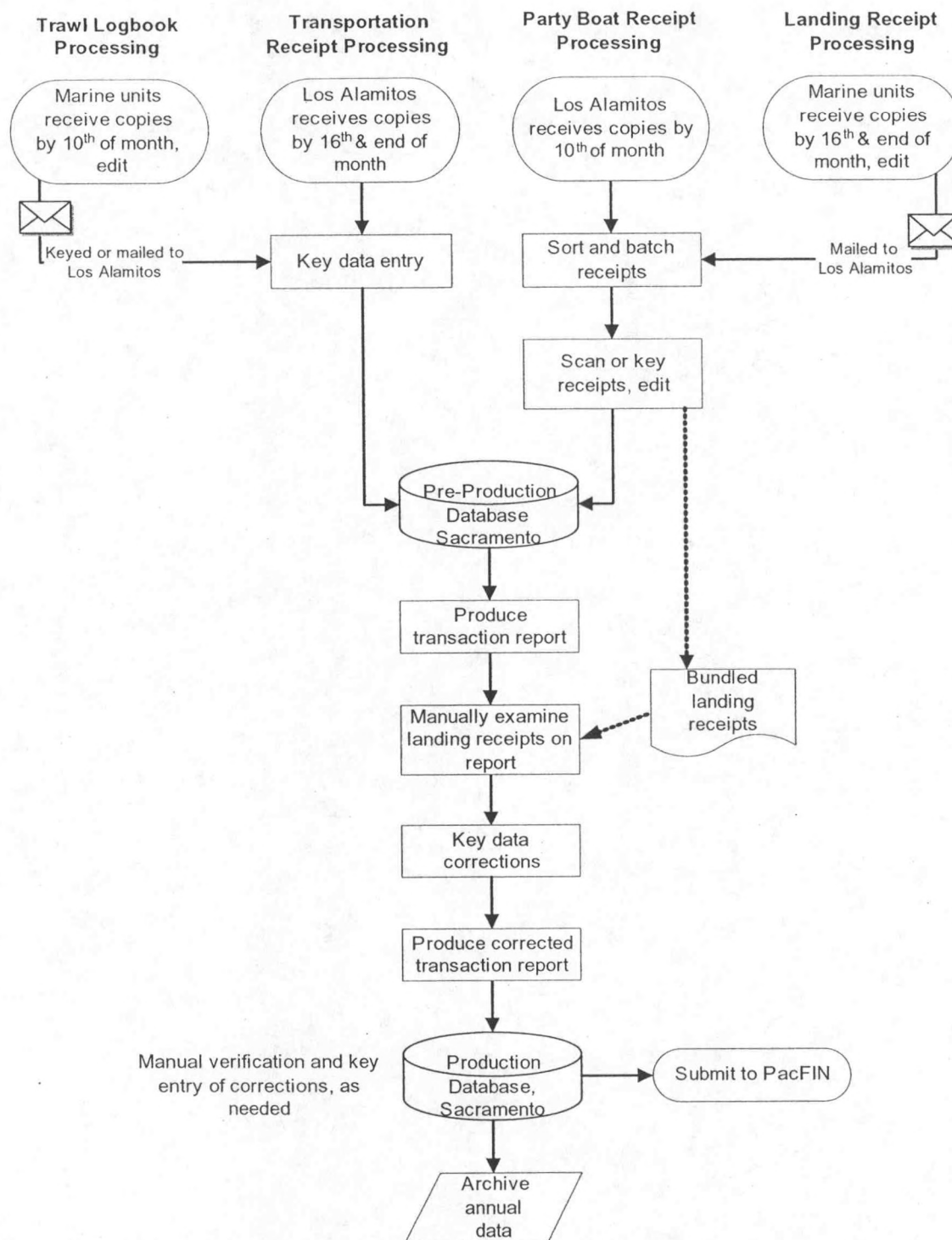Submit to PacFIN

Archive annual data

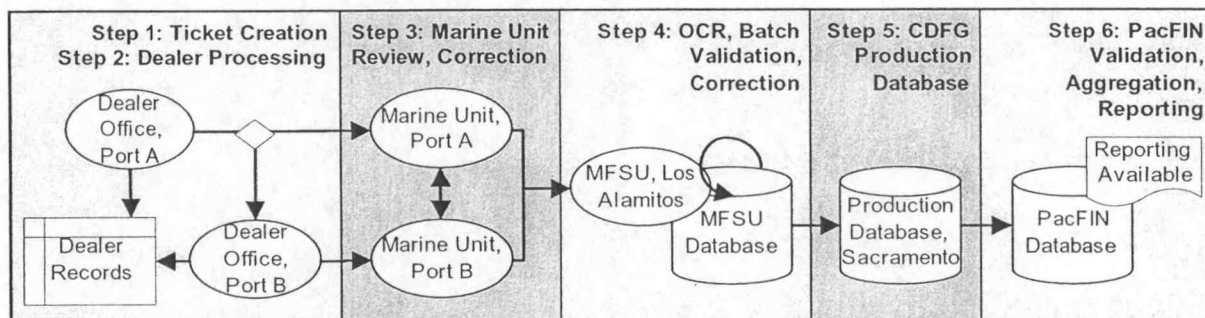*Figure 1 Overview of California Marine Fishery Data Collection*

Figure 2 California Commercial Landing Receipt Processing

California has 15 pre-printed paper ticket types, 10 of which are for commercial groundfish landings. Starting with dealer ticket creation, there are five to six points of data collection and manipulation in the "chain of command" from initial paper fish ticket to reports from the Pacific States Fisheries Information Network (PacFIN) database.

1. **Ticket creation.**

   The paper fish ticket is generated by a fish dealer at a given port. Data collected per ticket are discussed in section 4.2.

2. **Ticket submission to a "parent" dealer office and/or dealer accounting system (optional).**

   The paper fish ticket may be mailed to (or accompany a truck to) a "parent" or receiving dealer office. Here, the ticket (and likely other documentation) may be entered in the dealer's internal accounting system.

3. **Ticket submission to, review and correction by CDFG Marine Units.**

   The paper fish ticket is mailed to or picked up by CDFG Marine Unit personnel. Mailing must occur on the 16th and end of the month, respective to landed date, though pick-up typically occurs on a more frequent (weekly) basis. Marine unit fisheries technicians review and correct tickets. Corrections often concern missing state vessel registration numbers, incorrect market categories, or missing gear codes. The fisheries technician is usually familiar with his or her port's vessels and landings, and can make corrections accordingly; tickets from other ports may be corrected, though not as easily, and are generally mailed back to their originating port's marine unit office for correction and calculation of quota species. (Tickets from ports without marine unit offices are corrected through a centralized quarterly review process.)

   Marine unit fisheries technicians manually calculate landings of groundfish quota species on a weekly basis, from the tickets they have at hand, with landing dates no more than three weeks prior to the current date. Fishery technicians email results weekly to a CDFG office at Belmont, where they are reviewed and added to the quota species monitoring system (QSM) of PacFIN.

4. **Ticket submission to, validation and processing by the CDFG Marine Fisheries Statistics Unit (MFSU).**

   Paper tickets are mailed to the Marine Fisheries Statistics Unit at Los Alamitos, where they are visually inspected to identify those which are blank, damaged, or unreadable by Optical Character Recognition (OCR) software. Acceptable tickets are scanned by OCR into a temporary data store; unreadable tickets are manually keyed in.

Tickets are validated in a programmatic batch process, which is able to flag potential errors on almost all fields. Staff then review, research, and edit flagged tickets.

5. **Ticket submission to the CDFG production database.**

Text files of ticket records are submitted to an Oracle database in Sacramento. This is the final California data repository.

6. **Ticket submission to and processing by Pacific Fisheries Information Network (PacFIN).**

Detail data are sent to the PacFIN database semimonthly. Data is translated into PacFIN codes, copied to PacFIN files and processed by PacFIN staff in 1-2 days. PacFIN aggregates data as necessary for web-based summary reports[5].

After a fish ticket is created, it takes an average of 1.5 to 2 months for its data to be available for fisheries management, thus the need for the more timely weekly estimate provided by the PacFIN QSM system. As each step in CDFG ticket processing may take from 1 day to 2 weeks or longer to complete, all steps are considered equal candidates for improved timeliness.

4.2 Data Collected

Fish dealers are legally obligated to collect a core subset of data. CDFG's OCR processing and data repositories can and do store certain optional information if it is provided. The data items, both mandatory and optional, are described in Table 1 along with prevalent business rules for the organizations that enter or validate the data.

Table 1 Data Collected from California Commercial Landing Receipts

Data Item	Required?	Format, Business Rules
Ticket "Header" Information		
Permit Number	NO	Alpha-numeric (letters and numbers), 8 characters; federal or state issued permit.
Date, a.k.a. Landed Date	YES	MMDDYY format. Ticketing usually occurs on the same or next day of the landing.
Fish Ticket Number	YES	Preprinted on CDFG-supplied paper tickets. Unique. Comprised of 1 letter ticket type code and 6 digit number.
Fisher Last Name	YES	First three characters of the last name entered on ticket (with or without full name write-in).
Fisher First Initial	NO	
Fisher License Number	YES	L (preprinted) followed by 5 digit state license number.
Port of First Landing	YES	3 digit code. Must be a valid California port.

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[5] If a port's landings reflect less than 3 dealers, landings will be grouped into a larger context to protect dealer confidentiality.

Data Item	Required?	Format, Business Rules
Location Caught, a.k.a. Area Fished	YES	Usually a trawl block (3 digit code), but may be a larger area (4 digit code representing a combination of blocks).
Vessel Name	YES	First three characters entered on ticket (with or without full name write-in).
Vessel ID	YES	State vessel registration number, 5 digits.
Fish Business Name (a.k.a. Dealer Name)	YES	First three characters entered on ticket (with or without full name write-in).
Dealer Number	YES	5 digits state dealer id (license number), followed by 3 digit plant code.
For Each Landing Line Item		
Market Category	YES	Should match current California list of Market Categories.
Sub-Market Category (a.k.a. Grade)	N/A	Usually a size designation, but may also designate shallow and deep water dover sole. Generally part of the pre-printed line item market category, or written in. Exact size codes varied from dealer, pre-printed, and CDFG production records.
Landing Weight	YES	In U.S. pounds.
Price	YES	Positive numeric value. Determined by size and condition of fish.*
Condition	NO	Product code, i.e. dressed head on, head off, head and tail off or live.
Gear	YES	Must be a valid gear code.
Use Code	NO	Collected, if sent on ticket; includes personal use, bait, human consumption, etc. Human consumption is the default; if not the case, alternative use codes are manually keyed at Los Alamitos.

* For certain fisheries, such as herring, price may be assigned at a later date.

** Los Alamitos may refuse a ticket if no price is provided for a landing line item and no "personal use" has been indicated.

CDFG marine staff, in coordination with dealers, determine size or grade codes, market categories, port, gear, and condition codes, use and upper price limits. Dealer taxation is based on quarterly fish dealer reports, which are compared with tickets only upon audit. Taxes are assessed by landed weight for California.

4.3   *Opportunities, Expectations for Benefit with e-Ticketing*

From many perspectives, California's existing paper-based dealer ticketing process is satisfactory:

  ♦ all dealers have the resources to participate;

  ♦ fishers, dealers and marine staff are familiar with operations and data requirements;

  ♦ the process meets existing state and federal regulations, including same-day fisher signatures. The detail data exported from CDFG meets PacFIN data requirements, with the exception of data timeliness.

Several aspects of the process are already partially electronic. Given that, the principle impetus to venture into more fully electronic systems are as follows:

1. **To reduce the 1.5 month (minimum) time lag between paper ticket creation and data availability for management purposes;**

2. **To make critical data more complete and reliable for the most time-sensitive management decisions.**

    While data collection processes are in place to expedite the delivery of federally managed groundfish landings data, pilot participants felt that the data was at times not complete nor available soon enough to support truly responsive in-season management decisions.

3. **Improved data accuracy.**

    Electronic ticketing systems are commonly expected to improve data accuracy, either through better programmatic error prevention or detection or both, and by providing more accurate and efficient ways for all personnel to review and groom data. CDFG suggested a few accuracy goals (with or without e-ticketing), including: the capture of use codes; more reliable or detailed area fished information; more accurate market and submarket category codes; a reduction in missing data of any kind and a reduction in errors flagged after OCR processing and batch validation.

    It is important to note that improved data capture and accuracy are not seen as enforcement measures or a means to monitor infractions. Rather, it is widely thought that more timely, complete and accessible information would help fishers and dealers tune their in-season business decisions and allow councils to make more accurate and confident management decisions.

Beyond speed of delivery, a reduction in paper-based or manual processes is often associated with certain indirect benefits:

4. **Reduction in paper resource consumption;**

5. **Reduction in CDFG Marine Unit and MFSU overhead to physically transport and process tickets, leaving more staff time to validate ticket data.**

There is no expectation that e-ticketing would completely replace paper based systems in California in the near-term. First, there is a regulation (FG 8043) that requires signed paper copies of all tickets. Second, even if that regulation were amended, dealer resource constraints would still make it impossible for all dealers to

have the computing and communications resources necessary for e-ticketing. The top 20 dealers (ticket volume) account for about 40% of the total tickets for a year. Initial use of an electronic ticket system would probably target these 20 high volume dealers. Immediate feasibility aside, though, the ideal end goal would be completely electronic, one-stop data entry for all dealer, state and federal purposes.

5   OVERVIEW OF FISH DEALER CASE STUDY PARTICIPANT

Caito Fisheries, Inc volunteered to pilot test EFCL, entering a limited run of tickets into EFCL in parallel with their existing paper ticket and internal accounting processes.

5.1   Dealer's Organization, Technology, Readiness

Caito Fisheries, Inc currently delivers about 2000 tickets per year in California, and about 50 in Oregon. Their main office and administrative headquarters is in Ft. Bragg, CA, with four other offices (plants) in California and one in Oregon. Each plant submits paper tickets to the main or "parent" office for entry into the company's accounting system. Tickets are picked up by the Ft. Bragg Marine Unit of CDFG on a weekly basis.

The main office, where EFCL was piloted, has three computers running Windows 98. The office has a dial-up (56K) internet connection. They have been waiting for a high-speed connection for several years, but are ineligible for DSL (due to physical distance from a DSL service station) and are just outside the range of cable internet service (because of existing service load). See section 7.10 for more information about connection constraints.

There are 2 main data entry personnel in the office. These personnel were casually familiar with the web and web conventions; they do not use the internet routinely for business or personal purposes. They have worked with a software vendor to make changes to and configure their PC accounting applications. Their preferred screen resolution is 800 by 600 pixels.

5.2   Fish Ticket Process Details

Caito Fisheries primarily uses the X & D ticket types, trawl and crab respectively. The main office processes tickets and delivery weight tally sheets from all other offices into the internal system to produce fisher settlement sheets (payments and deductions). The process from intake to settlement is presented in Figure 3. While there are intricacies to the process not shown in the diagram, it is likely similar for most high volume dealers, particularly those with internal accounting systems. Within this example, there are two important points to note:

- ◆ CDFG tracks, and assess taxes by, off-load wet weight and a default set of price ranges per market category. Caito Fisheries tracks, and calculates fisher settlement by, dry or processed or "dispositioned" final product weights.

- ◆ This inherently produces two sets of data, with the potential for differing weights, size and grade (submarket) codes, prices, and more.

5.3   Opportunities, Expectations for Benefit with e-Ticketing

The fish dealership owner, Jim Caito, was a member of the Pacific Fishery Management Council for nine years, and expects that e-ticketing should deliver:

- ◆ near- to real-time landing data (particularly groundfish) for more responsive quota management decisions;

- ◆ preferably, one-stop data entry or a reduction in ticketing overhead, with either accommodation for his system (feeds to and from) or more streamlined reporting means.
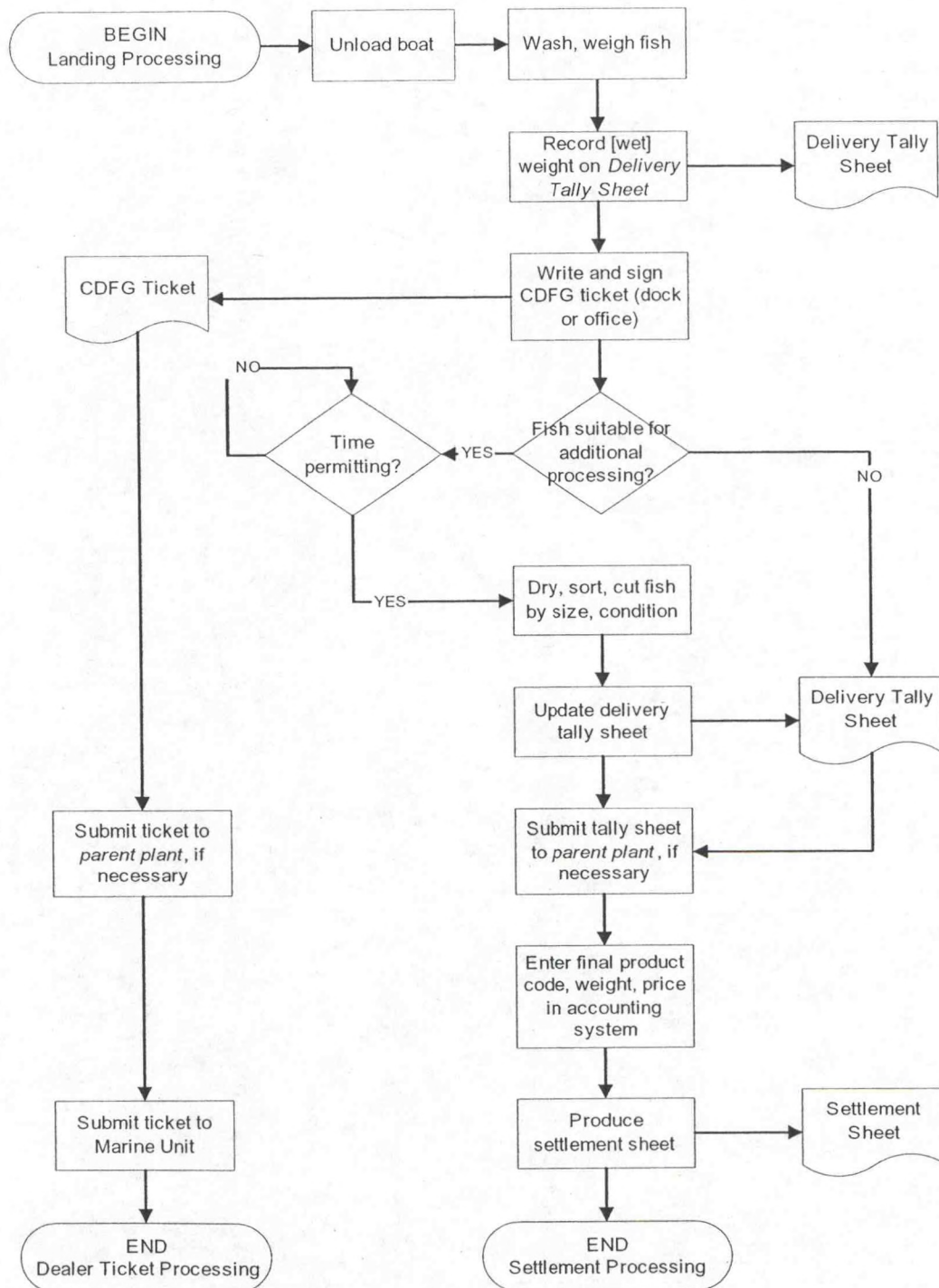
Figure 3 Caito Fisheries, Inc, Intake and Settlement Process

6 OVERVIEW OF THE EFCL SYSTEM

This section describes the EFCL system as it stood just prior to the California pilot, with particular attention paid to the features and administrative activities which support dealer ticketing.

Some interfaces and aspects of system setup were changed during the pilot. Many changes extended beyond planned configuration and were temporary; after the pilot, EFCL reverted to its original design as summarized here. Specific requests for change, and changes made, are discussed in section 7 as part of system evaluation.

6.1 *System Scope and Features*

EFCL was designed as a prototype to demonstrate the feasibility and value of a highly integrated electronic fishery data collection system. The system is comprised of ship-based software, a shore-based web application, and a database. (Section 6.2 provides details on the architecture and technologies.)

Major features of the ship-based software include:

♦ **Logbooks** – Skippers and observers may enter logbook records, configure crew and gear information per trip, and set up GPS inputs.

♦ **Species Composition and Biological Specimens** – Observers may enter catch, effort, discard, and sample data.

♦ **Reports** – Both skippers and observers may report logbook data in the form of CPUE Trip Reports, Trip Summaries, and Quota Share reports. In addition, there are a number of reports for observers' sample data.

Data collected through the on-board application are transmitted to the database through encrypted email transactions.

Major features of the web application include:

♦ **Logbooks** – Skippers and observers may upload logbook data and view or edit logbook entries.

♦ **Biological Specimens** – Observers and biologists may enter, view and edit sample data associated with logbooks.

♦ **Fish Tickets** – Biologists and dealers may enter and edit fish tickets; fishers may view those attributed to them. Biologists may reconcile logbooks with fish tickets.

♦ **Reports** – Users may view any fish tickets associated with them and print tickets in regional formats (currently WA, CA, OR). Skippers and biologists/managers may view Quota, Summary and Trip reports similar to the on-board reports.

The web-based application also includes interfaces to support user and reference data administration.

Three design principles shaped the system as a whole:

Broad Scope – Though many aspects of EFCL are oriented towards west coast groundfish data collection, system features were designed to satisfy cumulative state and federal data collection requirements for both U.S. and international fisheries. In practice, this means that the scope of features, and the data captured, may be more than an agency plans to implement at one time, and that some regional configuration is expected.

Data Integration – EFCL's data architecture was designed to integrate data from multiple sources and relate landing and sampling data back to its exact logbook and trip origin. In practice, this means that certain data items, such as logbook numbers, are required even in areas (such as fish ticketing) where they may not typically be collected. Also, that a core set of reference data relationships must be established and centrally maintained to support all functional modules, whether or not all modules are deployed.

Error Prevention – The system is focused on error prevention, at its data source and upon input. In practice, this means that almost all data validation occurs upon input, at the user interface level; little if any validation occurs once data has been accepted into the EFCL data repository. Also, that drop-down lists populated with reference data are used wherever possible, as opposed to permitting typed-in values.

6.2 Platform, Architecture and Technologies

The EFCL system is comprised of two applications and a database.

Ship-based or Onboard Application – This software is written in Visual Basic with some ChartFX components. Data is stored locally in a Microsoft Access database. The software runs on the Microsoft Windows 98 platform. Communications are handled through encrypted email transactions via satellite, Inmarsat C, or a modem and shore-based network connection. Users may also upload data files through the web application. The Onboard Application can be integrated with VMS and GIS add-ons.

Web Application – User interfaces and most reports are written in ASP 2.0, with a Microsoft IIS web serving platform running on Windows NT. Reports (single print-ready fish tickets) are handled by a proprietary Visual Basic .dll. The web application is best viewed in Internet Explorer, versions 4 and above.

Database – The system uses an Oracle database, version 8.1.7 at the time of this writing, though the data model can be adapted to most relational database types.

6.3 Security and Privacy

Access to EFCL features and data is controlled by the userID and PIN logon combination to which one or more user roles has been assigned. User roles reflect the business rules for data entry, viewing and editing; they are checked and enforced at the application level through session settings and ASP code and, for the most part, are not applied at the database level.

Onboard application communications with the server are secured through digital certificates and encrypted email transactions. Internet data transactions to and from the client browser and the web server are sent, unencrypted, via the HTTP protocol.

6.4 User Administration

An *agency* and *user role* paradigm controls access to features and data. An agency is typically considered to be a state or regional regulatory agency responsible for a given fishing region or management arena. Within an instance of the EFCL system (one database), an agency is the first thing that must be established, e.g. for the California pilot, a new CDFG agency was created.. More than one agency can co-exist within an EFCL instance; indeed, the ability to securely manage multi-agency data was a guiding design principle for the system.

Once an agency has been created, individual users (also called participants) must be added, assigned to an agency, and given one or more user roles. User roles

manage access to specific data within an agency. User roles include fisher/skipper, observer, biologist, processor/dealer, and data administrator. The observer and biologist roles have functional extensions which determine their scope of data access.

For all components of EFCL to work together (or even for dealer ticketing to stand on its own), the full set of participants must include:

- at least one data administrator, who can create users, grant user roles, and maintain the agency's reference data;

- all dealers or dealer plant users who will use the system;

- all biologists and observers who will use the system;

- all skippers and vessel owners who will land (i.e. have logbooks or fish tickets attributed to them or their vessels).

6.5   Data Administration

Each agency must set up and maintain its own personalized reference data. Reference data categories are listed below, not all are necessary for web-based dealer ticketing.

- **Ports** – All ports of landing.

- **Vessels** – All vessels that will land, for the entire agency, with a minimum of vessel name and Coast Guard Number.

- **Participants** – All participants as discussed in section 6.4.

- **Permits** – Permits may be assigned only after ports, participants and vessels have been established. Each vessel must be associated with at least one combination of two permits: a participant holding a federal groundfish permit for the vessel, and a participant holding a state fishing permit (or license) for the vessel.

- **Reference codes** – A number of agency-tailored codes including gear, size and grade, disposition, units of measure, target strategies, etc. *Only some necessary for ticketing.*

- **Events** – Fishing events applicable to logbooks, such as net sets, tows, etc.

- **Catch Categories** – Catch categories, applicable to logbooks.

- **Landing (Market) Categories** – Landing categories, applicable to landing receipts. These may be single species categories, or aggregates defined for management or processing purposes.

- **Species** – Common names related to species names. Note that statistical sampling by observers and shoreside fisheries technicians provides data regarding the true species composition of the landing (market) categories.

- **Limit Categories** – Defines a category that may have a limit on amount of catch allowed per permit per specified time unit.

- **Limits** – Numeric level of the limit for a particular category, permit type, and time period.

Most initial setup can be accomplished through direct, batch loads to the database, with ongoing maintenance accomplished through the application's web-based administrative interfaces.

6.6 Web-based Dealer Fish Ticketing

This section describes the features and user interfaces that were the focus of the California pilot.

6.6.1 USER INTERFACES: PROCESS AND PAGE FLOW

Upon login, processors are greeted by the processor home page, shown in Figure 4. There are four interfaces involved in dealer ticket entry, the flow of which is summarized in Figure 5.
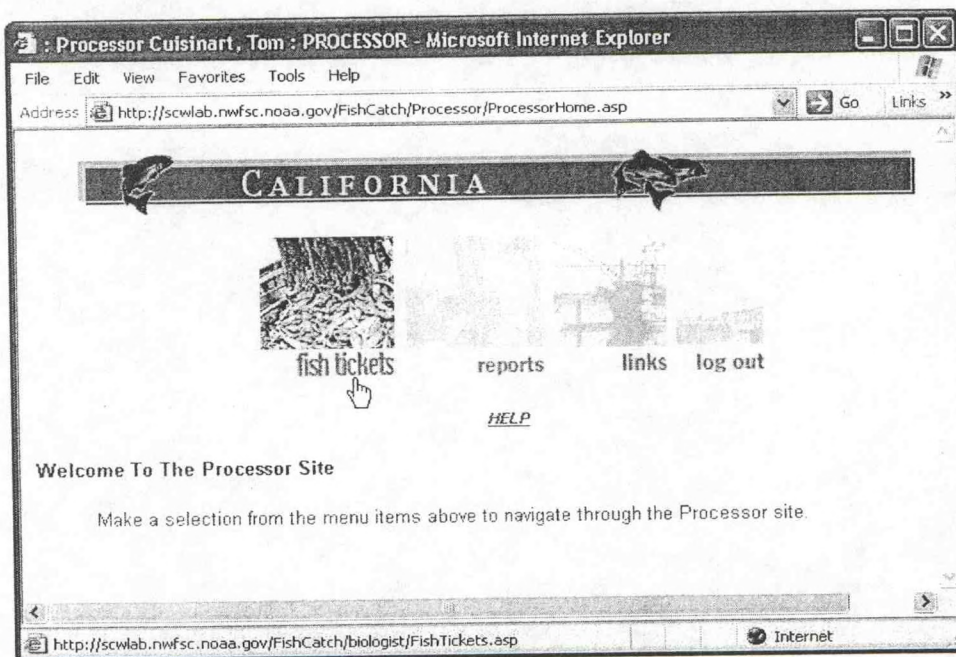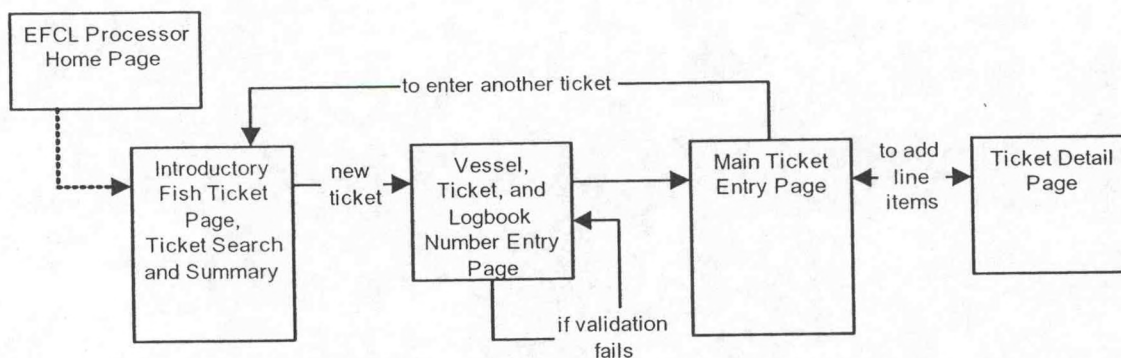

Figure 4 EFCL Processor Home Page

Figure 5 EFCL Ticket Entry Interface Flow

From the introductory search and summary page, shown in Figure 6, users click the *Enter New Ticket* button to proceed with an individual ticket. Ticketing steps are outlined below, followed by sequential pictures of each interface.

1. **Select a vessel, fish ticket and logbook number.**

   See Figure 7. Vessel selection populates a drop-down list with logbook numbers already associated with that vessel. The user selects a logbook from that list, or types in a new one, and enters a unique fish ticket number. Clicking Select (Save) establishes a unique logbook trip-to-ticket relationship for the vessel and validates the ticket number. If there are errors, users are returned to this page to start over; if not, they move on to the main ticket page, shown in Figure 8.

2. **Enter fish ticket header information.**

   The main ticket page screen has three sections: a top header area, a middle landing records area, and a bottom deduction area.

   The top of the main screen is reserved for all ticket information except for line-item landings per market category and deductions. Almost all of the fields shown in Figure 8 are required; details provided in the next section.

   Once header information is entered, the ticket must be saved to create the fish ticket and activate an *Add Details* button. The Add Details button will open the ticket details screen, from which new line-item landings are entered; this window is shown in Figure 9.

3. **Enter fish ticket details.**

   Enter ticket detail records by category, lbs, price, and other information, then Save to return to the main ticket page. Information from the ticket details pages updates the main ticket page, and can be modified from the main ticket page.

4. **Enter ticket deductions.**

   Deductions are somewhat generic, and can capture anything which would reduce the total ticket value.

5. ***Finalize* and Save. Print if needed.**

   Selecting the finalize radio button and saving marks the ticket as official, and available for review / edits, if necessary, by users with the *biologist* role. Once the ticket has been finalized and saved, users must close the main ticket page, return to the introductory page, and start again with a new ticket.

Figure 6 EFCL Fish Ticket Introductory Page, Ticket Search and Summary

Figure 7 Vessel, Fish Ticket and Logbook Number Page

Figure 8 EFCL Main Fish Ticket Page

Figure 9 Ticket Detail Page, Abridged

6.6.2 DATA COLLECTED

Table 2 summarizes the data collected from EFCL fish ticketing interfaces. This data, to the line item, is accompanied by dates of and participant userID responsible for creation and modification. With a few crucial exceptions, data requirements reflect front-end interface rules, not data model or database rules; thus, many data format requirements can be modified by a web developer.

Table 2 Data Items Collected from EFCL Fish Ticket Interfaces, Prior to California Pilot

Field Name	Required?	Default Value	Available Data and Origin; Data Entry Rules
Fish Ticket Pre-Header Information			
Vessel Name / Coast Guard number	YES	Blank	Drop-down list of agency vessels.
Fish Ticket Number	YES	Blank	All digits; must be unique for the agency.
Logbook number	YES	Blank	Drop-down list of logbook numbers previously attributed to the vessel, or a type-in of a unique logbook number.
Fish Ticket Header Information			
Federal Permit Holder / Permit Number	YES	Blank	Drop-down list of all Limited Entry Groundfish permits associated (as part of data administration) with the vessel.
Landed Date	YES	Current date	MM/DD/YYYY format.
Fish Ticket Type	YES	Blank	Accepts any 1 character (letter or number).
Port of Landing	YES	First port alphabetically	All ports available for the agency.
State License Holder / License Number	YES	Blank	Drop-down list of all state licensed fishers associated (as part of data administration) with the vessel.
Location Caught	YES	Blank	Free form text entry.
Days Fished	YES	Blank	1 digit.
Fish Dealer	YES	Logged in fish dealer	Will list all agency fish dealers if a biologist is creating the ticket.
Fish Business Name	NO	Blank	Will list any participant with a Corporate Name; this field is under review for its utility.
Note	NO	Blank	Permits any text up to 100 characters.
Primary Gear	NO	Blank	For some agencies, primary gear must be specified for a fish ticket. EFCL itself accepts blank entries.
Outside 3mi (3 miles)	NO	Deselected	
Outside enhancement	NO	Deselected	
Finalized	NO	Deselected	Once finalized, the fish ticket is no longer editable by the fish dealer who created it.

Field Name	Required?	Default Value	Available Data and Origin; Data Entry Rules
Ticket Detail Records (Line Item Landings)			
Size or Grade	NO	Blank	Accepts at least 2 letter or number characters; possibly more.
Species	YES	Blank	All agency's landing/market category common names.
Pounds	YES	Blank	Kept in integers only; decimal input will be rounded up.
Price	YES	Blank	Dollars and cents; no blanks.
LBS Weigh Back	NO	Blank	Kept in integers only; decimal input will be rounded up.
LBS Take Home	NO	Blank	Kept in integers only; decimal input will be rounded up.
# Fish Take Home	NO	Blank	Integers.
Cond or Disp	NO	Blank	1 char, numbers only, 1-9.
Gear	NO	Blank	Free form text.
Ticket Deductions			
Description	YES, if used	Blank	Free form text entry.
Amount	YES, if used	Blank	Integers. Will be deducted from total ticket value.
Unit of Measure	NO	Blank	Agency designated unit of measure codes.

6.6.3   REPORTS

Currently, dealers have only one "report" available in EFCL: individual fish ticket reports in the paper format of Washington, Oregon or California. Figure 10 shows the EFCL version of a California-formatted ticket.

Figure 10 Individual Ticket Report, Printed in California Format

7   SYSTEMS EVALUATION

The pilot and systems evaluation began with a few general questions: Could EFCL collect the proper data? Would it encourage use? How would it tie-in with or change existing operations and regulations? Could CDFG maintain the system in a production deployment?

As the project team learned more about the EFCL system and the context(s) in which it would operate, we were able to refine a set of system features and qualities through which EFCL or any e-ticketing solution might truly add value. Some of these qualities were unique to dealer ticketing (such as the ability to accommodate all landing receipt types); others stemmed from criteria applicable to any system, such as performance, security, usability, and platform.

This section examines each quality in-depth, combining observations from all pilot stages to present needs meet, system modifications made or needed, constraints and alternatives regarding both the system and ticketing operations.

7.1   *Summary of Results*

Table 3, below, provides a summary of the system features and qualities, along with their importance or criticality for California, the level of satisfaction demonstrated during pilot use, the changes needed for production deployment and the estimated feasibility of those changes for developers already familiar with the system. The criticality and satisfaction "rating" of EFCL features is specific to California's evaluation of EFCL for purposes of e-reporting of fish tickets; other agencies with different immediate goals may have different perspectives.

Table 3 Summary of EFCL Systems Evaluation Results

Table Key			
Criticality (Crit.): 3 = Required; 2 = Nice to Have; 1 = Optimal / Optional; 0 = Unwanted **Satisfaction**: Insufficient, Meets, or Exceeds **Feasibility Estimate**: Minor (limited time and effort), Moderate (substantial time and effort, with limited scope), Major (substantial time and effort, widely scoped or integral components)			
System Feature or Quality	**Crit.**	**Satisfaction**	**Recommended Changes & Feasibility Estimate; Notes**
User-Facing Features and Qualities			
Ability to Accommodate All Landing Receipt Types	3	Insufficient	A major development effort needed to properly accommodate and manage both state and federal permits.
Ability to Associate Landing Receipts with Logbooks/Trips	0	Meets	
Ability to Tailor Ticketing Interfaces and Data Input, Format, and Validation Rules	2	Meets	Interface and validation customization was acceptably implemented for CDFG; customization at the group or user level is not available. Tied to ability to manage validation and changes.

Ability to Collect, Translate and Export CDFG-Required Data	3	Exceeds	
Ability to Improve Data Accuracy	2	Insufficient to Meets	*As configured for the pilot and given current operations*, EFCL cannot stand on its own to provide the error prevention and detection necessary to improve data accuracy.
Ability to Print Individual Tickets In California Format	2	Meets	Would satisfy hard-copy signature requirements, if necessary.
Ability to Provide Reports	2	Meets	Would require minor to moderate development for security, functionality.
Ability to Manage Workflow and Data Manipulation	1-2	Insufficient to Meets	Would require minor to moderate development to allow marine unit to mark reviewed tickets, and determine appropriate processing. Tickets validated, on entry, as much as current system; would require tie-in with or development of record-level validation processes. No true tracked changes; would require moderate-to-major development to do so.
Performance	2	Insufficient	Insufficient on dial-up connections.
Usability	2	Insufficient	Flow, flexibility of use not satisfactory for dealer.
System Administration, Deployment And Maintenance Considerations			
User Administration	2	Insufficient to Meets	Minor development would improve PIN and administrative features; major development for group administration.
Data Administration	2	Insufficient to Meets	Minor development to facilitate reference data load, administrative interfaces. Tied to ability to accommodate all permit types.
Security and Privacy	3	Insufficient	Minor development (purchase of SSL certificates) necessary to ensure secure communications; no flexible way to manage data access permissions.
Platform, Architecture and Technologies	2	Insufficient	ASP 2.0 code would require purchase and support of non-native platform. System provides no alternatives to web-based ticket entry.

7.2   Ability to Accommodate All Landing Receipt Types

Landing receipts are subject to a number of data requirements, some of which may differ slightly depending on the fishery. EFCL proved able to accommodate all of California landing receipt types and data requirements with the notable exception of the handling of permits.

EFCL requires that *every* fish ticket be attributed to a valid[6] federal Limited Entry Groundfish permit *upon ticket entry*. This reflects its orientation towards groundfish management priorities and error prevention. CDFG, however, does not require nor routinely collect federal permit numbers on its landing receipts. While the data *is* in use at several levels[7], and, if collected, transmitted[8], it is not strictly enforced on the ticket nor during state data processing. Further, some landings do not require a permit (including some groundfish landings), and some landings may be attributed to state permits of varying type and format, such as for Dungeness crab and salmon.

To proceed with the pilot, EFCL had to be altered to accept tickets with permits of varying format and those without permits. Because EFCL's federal permit requirement is deeply embedded in application design and seemingly reliant on a fixed format, alterations compromised a number of data relationships, error prevention, validation and reporting features. The alterations can not be considered production suitable and they had consequence in data accuracy (see section 7.6).

Determining where and how associations between vessels and fishers and state and federal permits should occur appears to be a very common issue in e-ticketing system development and implementation, as does determining how to use the associations to populate, validate and track landing data. Should CDFG decide to consistently capture, validate and retain all types of permit data at the state level as part of its e-ticketing strategy, and should EFCL be used for these purposes, the system would require significant development effort, most so because of the scope of features which would require inspection and likely modification.

7.3   Ability to Associate Landing Receipts with Logbooks/Trips

EFCL combines user-entered logbook numbers with back-end (system generated) trip identifiers to allow species composition and biological samples and landing receipts to be traced directly back to the trip they originated from. This also allows fisheries technicians' reconciliation of logbooks with tickets. However, CDFG and dealers said that logbook numbers are not commonly collected and that it was likely unfeasible to require fishers or dealers to provide logbook numbers at this time. For the pilot, EFCL was easily changed to create logbooks in the background. This issue would not affect its primary ticketing capabilities, although some reporting changes would be required. Tickets could no longer be associated with (or reconciled with) logbooks.

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[6] At least one federal permit must be assigned to a vessel (as part of data administration) before the vessel can have landings.

[7] Fishers and dealers who wish to track landings against federal permits and quotas do so by developing their own manual or software-based tracking systems. Fisheries technicians and biologists may do the same, such as for QSM purposes, to identify major infractions or for fisheries management.

[8] If any permit data is explicitly written on a fish ticket, CDFG's OCR processing accepts and transmits the information to the CDFG production database. PacFIN can match state vessel registration number, federal groundfish permit and/or state permit with fish tickets. CDFG routinely matches state vessel registration or fisherman license with state permit and fish tickets.

Fishery statisticians and analysts do commonly need to relate logbook to fish ticket data. Current efforts to use database procedures to link logbook records with fish ticket records are often tedious and error-prone. Thus, the need for a feasible way to collect this information at data entry remains desirable.

7.4 Ability to Tailor Ticketing Interfaces and Data Input, Format, and Validation Rules

CDFG and dealer data entry personnel generated a number of RFCs to tailor EFCL's ticketing interfaces to their preferences regarding data input, format and validation. The majority of these RFC were met with relatively minor development effort (less than 30 hours of work). There are two important points to clarify as to how changes would apply in a production deployment.

♦ EFCL allows administrators to explicitly tailor two things for an agency: the agency logo, which will appear on most web pages, and the reference data which will be used to populate and in some cases validate ticket fields. The system is not set up to customize page design or page components on an agency, group or individual user basis. In other words, changes to the EFCL web application or database would have to satisfy a common and standardized set of user preferences for all agencies and participants using that instance of EFCL.

♦ EFCL is also not set up to provide nor customize "record level" validation subsequent to ticket entry. That is to say all validation occurs as "error prevention" on a field by field basis upon ticket entry or modification; there is no separate record level or batch validation that occurs as "error detection" after data has been accepted into the database. Again, while the reference data used to perform validation can and should be customized for an agency, the business rules and actual methods of validation (carried out by each page's code) must be commonly accepted by all users.

So, while the modifications summarized in this section were a satisfactory approach to the pilot case study, they may not be deemed serviceable to all potential users. To begin, a few top level navigation and usability issues (discussed in section 7.11) resulted in a slightly modified interface flow as shown in Figure 11. The flow of these interfaces dictates the order of field format and validation RFCs presented in Table 4.
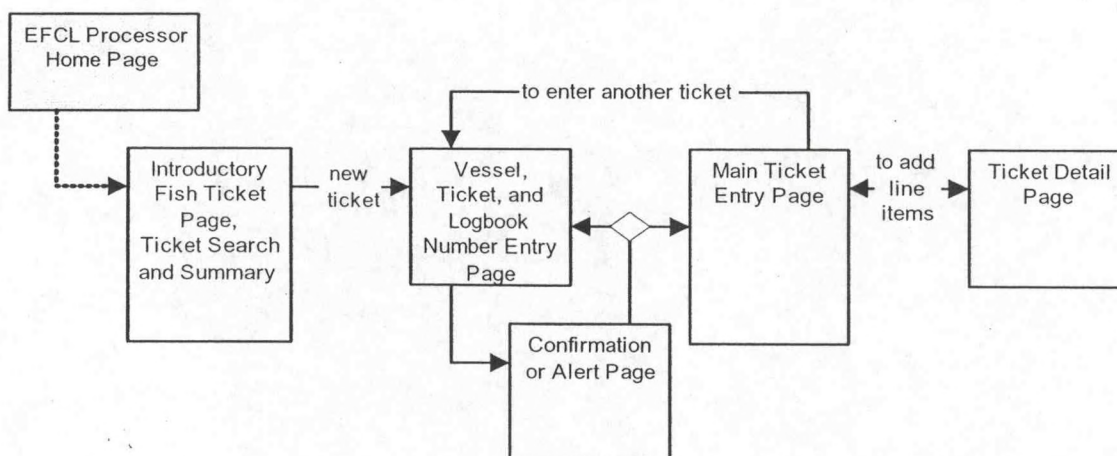
Figure 11 EFCL Fish Ticket Interface Flow, Modified for the California Pilot

Table 4 Data Items Collected from Fish Ticket Interfaces, Modified for the California Pilot

Field Name	Required?	Default Value	Available Data and Origin; Data Entry Rules
Fish Ticket Pre-Header Information			
Vessel Name / CDFG Registration Number (a.k.a Vessel ID)	YES	Blank	Permits type-in of state vessel ID, which is validated against a California pilot specialized table. Always prompts for confirmation or re-entry; if user moves ahead with vessel ID that is not in the system, vessel name "CAPILOT" is assigned but vessel ID is retained. Vessel name and ID number cannot be changed after pre-header information is saved.
Fish Ticket Number	YES	Blank	Characters and digits; must be unique for the agency, incorporating the "Fish Ticket Type" code with entry of ticket number.
Logbook Number	N/A	N/A	Removed; now assigns unique number in the background.
Fish Ticket Header Information			
Federal Permit Holder / Permit Number	NO	Permit assoc-iated with vessel.	Shows one permit historically associated with the vessel ID through CA-pilot customized tables. Accepts type-in (type over default).
Landed Date	YES	Blank	MMDDYY format. Default is blank instead of current date as, for Caito Fisheries, the ticket would rarely be entered into EFCL on the landed date.
Fish Ticket Type	N/A	N/A	Removed. Combined with Ticket Number.
Port of Landing	YES	First port alphabeti cally	Only Caito Fisheries' ports loaded as reference data.
State License Holder / License Number	YES	Blank	Shows one skipper license historically associated with the vessel ID through CA-pilot customized tables. Accepts type-in (type over default).
Location Caught	YES	Blank	Maximum of 4 digits; no other validation.
Days Fished	N/A	N/A	Removed.
Fish Dealer ID	YES	Logged in fish dealer	Automatically populated from user profile, a combination of state Dealer ID and plant code. As there was only one user, tickets coming from other Caito Fisheries' port offices did not carry their originating plant code.
Fish Business Name	N/A	Blank	Removed. Redundant with information gleaned from Fisher Dealer ID.
Note	NO	Blank	Free-form text entry.

Field Name	Requ ired?	Default Value	Available Data and Origin; Data Entry Rules
Primary Gear	YES	Blank	Code list provided by CDFG; interface would not permit non-listed codes.
Outside 3mi (Outside 3 miles)	N/A	N/A	Removed; dealers reported they did not gather the information.
Outside enhancement	N/A	N/A	Removed; dealers reported they did not gather the information.
Finalized	NO	Deselect ed	Once finalized, the fish ticket is no longer editable by the fish dealer who created it. Used to mark hand-off to Marine Unit.
Ticket Detail Records (Line Item Landings)			
Size or Grade	NO	Blank	Setup with dealer's preference for size/grade codes (and shallow or deep water sole), as dealer collects on weigh sheet and enters into internal account system. Required minimal translation for CDFG export.
Species a.k.a Market Category	YES	Blank	Drop-down list, now carrying (and ordered by) market category code (as opposed to just category common name). Dealer would have preferred to type category code in one field, then have the category name appear in another field for confirmation.
Pounds	YES	Blank	Right aligned, with decimal places, in traditional decimal format, although dealers usually record lb in whole numbers.
Price	YES	Blank	Right aligned; automatically updated with 2 digits (0's) past decimal as needed.
LBS Weigh Back	N/A	N/A	Removed.
LBS Take Home, a.k.a. Personal Use	NO	Blank	Altered to allow 1 character type-in to flag line items taken for personal use (and which would thus carry no price).
# Fish Take Home	N/A	N/A	Removed
Cond or Disp	NO	Blank	1 char, numbers only, 1-9, CDFG codes.
Gear	NO	Blank	Code list provided by CDFG; interface would not permit non-listed codes.
Ticket Deductions			
Description	N/A	N/A	Unused; deductions not captured on CDFG tickets.
Amount	N/A	N/A	Unused; deductions not captured on CDFG tickets.
Unit of Measure	N/A	N/A	Unused; deductions not captured on CDFG tickets.

In addition to the RFCs in Table 4, dealer personnel requested the ability to delete and reorder ticket line items; both features were already built in. Dealer personnel also requested that unused fields be dropped from the interface whenever possible, and that field navigation (via the Tab key) stop only at required fields. The cumulative changes resulted in the modified main ticket interface as shown in Figure 12.

Figure 12 EFCL Main Ticket Page, Resulting from Modifications for the California Pilot

7.5 Ability to Collect, Translate and Export CDFG-Required Data

All CDFG-required data was collected and easily exported with only a small amount of translation, particularly for size or grade codes, as they were formatted to dealer preferred codes. Timestamps and other tracking data were not exported. In a production environment, it would be straightforward to have an automated script port data from the EFCL database to a CDFG database.

7.6 Ability to Improve Data Accuracy

The pilot generated 54 total tickets, 50 from dealer personnel and 4 from the fisheries technician, 33 crab and 11 groundfish. During the case study, the fisheries technician made modifications to approximately 10 tickets, almost always to correct a market category code still present on printed tickets but defunct and replaced by two more specific category codes. (Thus, his changes were made to both paper and EFCL ticket records).

Project leads were able to compare EFCL's ticket records to CDFG's production ticket records and, in most cases, back to the original hard-copy ticket. We documented the following differences in data:

♦ There were 8 differences in fisher license number, with CDFG's production records being correct. We concluded that when the default fisher information was not correct, dealer personnel almost always corrected the fisher name, but would mistype or neglect to change the license number. This clearly indicates that either EFCL's original drop-down list approach or a fully working cross-check between any typed-in fisher name and license number (as dealer's native accounting systems do and as was requested) would be crucial to preventing fisher identification errors.

♦ There were 4 instances of missing permit numbers in EFCL, all pertaining to crab landings. Two appeared to result from the intentional deletion of the default groundfish permit number; two were simply not entered. In comparing permit data, we found a number of CDFG production records where groundfish permit numbers had had their leading zeros trimmed and an inconsistent capture of the alpha characters associated with them.

♦ There were a few differences in line item market category and submarket size and grade codes, with EFCL appearing to have the correct data. The suspected cause is that the California ticket carries pre-printed line items which are a combination of market category and submarket (size/grade) information. Dealers will occasionally hand write different size/grade information over the pre-printed items. Fisheries technicians can add corrections at the bottom of the ticket in an area set aside for these types of changes, but that area offers no place to indicate submarket information. Handwritten changes of this type can be misinterpreted during the scanning process. EFCL separates market category from size or grade codes, allowing dealers and fisheries technicians to enter or modify this information with much less chance of transcription error.

♦ There were at least 4 incorrect vessel names or IDs in EFCL ticket records. 2 were the result of landings by vessels not in the list of default values loaded for the pilot, 1 was the result of a mistake on the hard-copy ticket, and 1 of undetermined origin. In all cases, vessels received a default "CAPILOT" name, and so were easy to spot; also in all cases, the correct vessel name had been indicated in EFCL's ticket notes field. Unfortunately, no one can change vessel IDs and names once the ticket has been created. This implies the need for a validation approach similar to what is recommended for fisher information, accompanied by a load of all possible agency vessels, and some means for users and system administrators to accommodate new vessels without holding up the ticketing process.

♦ There were 2-3 instances of differing "port of first landing", also typing errors, with CDFG's records holding the correct values.

Collectively, these differences in data indicate no significant gain in accuracy from using the EFCL system *as it was configured for the California pilot*. The pilot did demonstrate several opportunities for an e-ticketing system to borrow from and augment the business rules for validation already in place at the MFSU (and dealer systems) and apply them to tickets as they are created, reducing the amount of manual error checking and the possibility of transcription error.

7.7 *Ability to Print Individual Tickets In California Format*

EFCL's individual ticket printout was well received (see Figure 10). We felt that a printed (as opposed to hand-written) ticket might better facilitate OCR scanning with

less transcription errors, and would serve if signed paper copy was necessary for legal purposes.

There are three caveats to the utility of printed copies. First, there is no provision for the EFCL system to generate unique ticket numbers. Either those numbers would have to be drawn from CDFG printed tickets or EFCL would need a simple modification to generate them. Second, if EFCL's printed tickets were sent through the usual process, this makes for no less paper or manual processing- although it could still allow preliminary or "unvalidated[9]" data (particularly quota species data) to be transmitted in near- to real-time, possibly automating fisheries technicians' QSM activities. Third, if some paper records were needed but same-day fisher signatures were not, it would be useful to be able to select and print a group of tickets at once.

7.8   *Ability to Provide Reports*

7.8.1   DEALER DATA REPORTING

Caito Fisheries personnel suggested a limited number of landing summary reports, including:

- monthly total per market category, in lb and price;

- date range total, in lb and price, categorized first by vessel, then by market category;

- monthly tax totals for California and Oregon (in price for California, in lb and price for Oregon), with market categories aggregated into groups that share same tax rate.

State tax calculations are now done by hand from paper tickets. On-demand calculations would be a tangible benefit of e-ticketing, at least for this dealer. Dealer personnel also felt that summaries of vessels' landings or quota taken could be useful. Caito Fisheries is already able to provide landing estimates from its accounting system and, when necessary, manually compare landings to quota information from the fisherman. EFCL's advantage would be to report landing totals as CDFG has record of them and (if implemented close to its pre-pilot design, including full participant and permit information), to deliver quota reports from all ports' landings directly to fishermen.

Preliminary reports were delivered, along with new report features to permit searches by a date range or fixed period, with one or more vessels, with one or more market categories. Figure 13 shows an example search and report.

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[9] See section 7.9 for more explanation of "unvalidated" data.

Figure 13 Dealer Landing Summary Report, by Vessel and Market Category

7.8.2   OTHER REPORTING, SEARCH AND SORT FEATURES

While dealer data entry personnel were not interested in flexible search and sort features (as two to three fixed reports would serve their needs), the marine unit fisheries technician who participated in the case study did request much improved search and sort capabilities.

The introductory search and summary page, as presented to someone with the *biologist* role, will look similar to that which is presented to the dealer (Figure 6), except that the ticket list will include all those that the biologist (fisheries technician) has access to- usually confined to his or her port, but spanning multiple dealers. The fisheries technician was primarily concerned with reviewing tickets in a meaningful fashion. He wanted to be able to search by date landed (specific dates or a range), or gear, or vessel, or dealer, and more, and to sort the data retrieved by any field. He also wanted to mark tickets he had finished processing (discussed more in the next section). Both CDFG and NWFSC project leads reviewed tickets and requested similar search and sort functions.

The need for search and sorts was uncovered late in the case study and the only RFCs to be implemented were to permit a temporary search by dealer ID and a default sort order by landed date. While the ability to offer more search, sort or report features would require new development, it would be a relatively simple matter of retrieving and displaying existing data in new pages, according to the appropriate role access. Search, sort and report features could be constructed to help automate QSM activities.

7.9 Ability to Manage Workflow and Data Manipulation

The project team was interested in how EFCL would tie-in with or alter existing workflow as tickets changed custody from dealer to marine unit to MFSU to production records.

We considered a somewhat ideal workflow scenario: all dealer offices have the computing resources to use EFCL; tickets are entered and signed electronically at their originating port; mechanisms would be in place to allow any main, parent, record-keeping or receiving dealer offices to view new tickets and process them accordingly. After finalization, data would be immediately available to the appropriate marine units to review and correct as needed. Once marine unit review was complete, data could flow to the CDFG production database in a clearly specified manner.

Figure 14 depicts a scenario closer to what was demonstrated in the case study, followed by a discussion of notable issues.
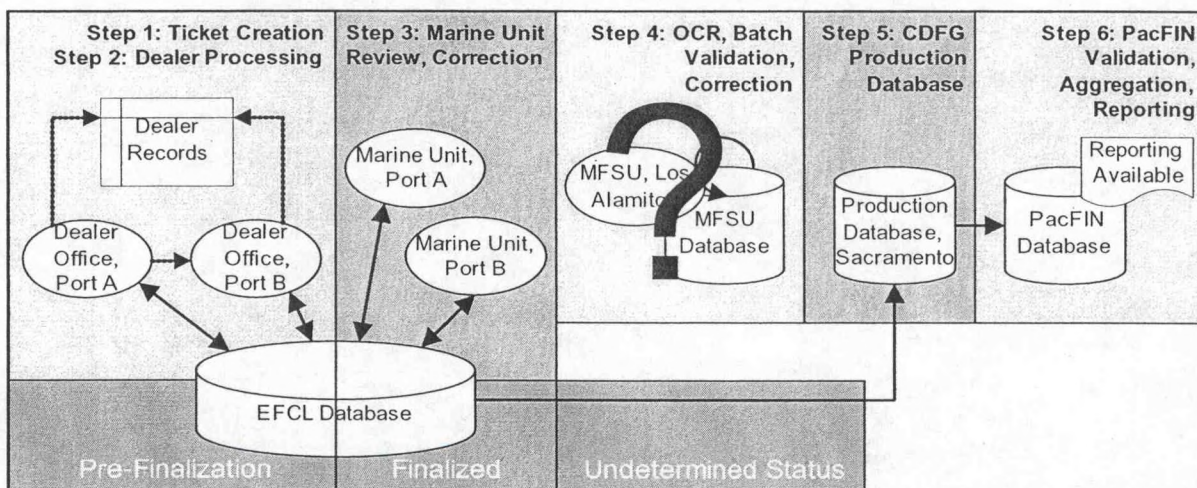
Figure 14 Possible Scenario of Work and Data Flow with EFCL

Dealer Data Sharing – In existing dealer processes (Figure 14, Steps 1 and 2), some plants submit fish tickets to a main or parent plant for a variety of record-keeping needs and legal requirements. The parent office shares data from all plants. Within EFCL, this data sharing is not explicitly possible. One dealer user, with one EFCL userID, cannot review or change tickets created under another's userID. Specialized reports could certainly be developed to allow parent offices to review all their data, but because of the way each page manages access to data based on fixed user roles, it would be difficult to allow some dealer users to change the data of others in their "group".

Indicating Changes in Custody and Status - EFCL provides a way for dealers to indicate that a ticket is finished and ready to be released to CDFG custody, which proved very useful during the case study. Dealers may mark tickets as "finalized", which sets a permanent *official date* after which dealers cannot change data but fisheries technicians (with the biologist role) can. Unfortunately, ticket search and summary interfaces do not display the "finalized" indicator, nor allow technicians to search for finalized tickets as they become available. This would require a very simple modification to the search and summary interfaces. Following that, there is

also no way for technicians to indicate when they have completed their review and modifications[10]. Such a status indicator could be used to mark tickets as ready for the next stage in processing, such as export to centralized CDFG processing.

Tracking Changes – The concept of ticket data flow and status cascades into the larger issue of tracking changes. In California's existing processes, fisheries technicians make necessary changes to tickets and extract time critical quota species information that cannot wait for the paper-based method to process. However, any ticket changes result in at least two sets of records: dealer originals, and CDFG modifications. While there is little concern that inappropriate or inaccurate editing occurs, there is an urge to make ticket modification more visible and trackable. EFCL does track ticket modifications to the line item by recording a modified date and the userID of the person who last modified the item. What it does not do is keep a history of the specific changes made. If this feature were deemed necessary, a considerable development effort would be required.

Detecting and Flagging Errors – The case study highlighted that EFCL provides no batch or record level validation past ticket entry, and no mechanism to flag errors for human review. Data collected would receive no such validation unless it were delivered back into the MFSU's pre-production data store. Such an approach would perpetuate the manual processing and data lag as exists in the current system. Further, it would continue to place emphasis on MFSU personnel to review and modify data, instead of providing new ways for fishers, dealers and fisheries technicians to review and correct data as close to its source and time of creation as possible, with local knowledge and continued access to their own data.

7.10 Performance

The most significant hurdle in the EFCL California pilot was system performance. While a number of factors can influence web application performance (client browser and computing resources, page graphics, client and server side validation, data exchange, server load and network settings) the most influential and clearly isolated factor in the case study was the speed of the users' internet connection.

Per ticket, EFCL makes 4-6 trips to the server and database. For Caito Fisheries, on a 56K dial-up connection, the estimate was that slow web performance more than tripled the total time it would take for them to enter a single ticket on their internal systems (1 minute per, vs. 3 minutes per). For anyone used to working with repetitive data entry work, indeed, for most people used to working with the internet, such a speed would render an application almost unusable. Reports, at least, were still usable, as they made only trip to the server.

EFCL's performance carries implications for the viability of web-based dealer ticketing. Users' connection speed is a variable that developing or acquiring bodies cannot control, and high-speed internet connections cannot be assumed for a variety of reasons:

♦ **Region or physical location** – some dealer and marine unit offices may be in an area that high-speed lines will not reach for some time due to physical or market constraints; this is true for Caito Fisheries and the Ft. Bragg marine unit[11].

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[10] EFCL tickets do carry with them another status flag beyond finalization, and that is "pending" or "reconciled", which applies only to the reconciliation of logbooks and is only available if a logbook record exists. Thus, it would not work for routine ticket processing as described.

[11] Even if an office is located in a connected region, it may lie just outside the scope of service. For example, both Ft. Bragg offices are too far from the SBC service station to gain DSL service; cable

♦ **Cost** – even if service exists, offices may have to pay additional fees for the high-speed connection, along with an investment in networking and related machine upgrades. For dealer offices with no computing resources, they would have to absorb even more cost to participate.

♦ **Resistance** – "always on" internet connections bring new level of networking and security concerns. Even if offices have access to such connections, they may not be comfortable enough with it, security wise, to make it available on enough machines, via networks, to be conveniently used for e-ticketing.

A number of feasibility studies exist on the DSL, Cable, and ISDN options and limitations particular to California or northern California, and for other regions, and as well as satellite communications options. As part of this project, the CDFG project lead asked marine units to survey high volume dealers to determine what percentage of users would have access to computers and or high-speed internet connections. More implications of EFCL's e-ticketing platform are covered in 7.12.4.

Performance in terms of load balancing, number of simultaneous users, data transmission loads and other measures of performance were not examined.

7.11 Usability

Judging usability is an important part of any acceptance testing. Whether or not a product meets functional requirements, usability factors contribute to the consumer's ability to learn and productively operate a system, in turn affecting consumer acceptance, confidence, and the likelihood they will adopt and maintain the system.

The usability issues presented were those discovered during both heuristic evaluation and user acceptance testing. Issues, for the most part, are not labeled for the specific heuristic principle they lack in; rather, they are more often labeled and described in terms closest to the user's language.

Prefacing this discussion is that positive aspects of EFCL usability existed, but are not included here. Also, that usability issues, particularly those related to pure visual design, would be very easy to correct with minimal development effort.

1. Unwieldy Flow and Number of Interfaces

Recalling the process outlined in section 6.6.1, the foremost usability complaint was that each ticket took 4-5 screens to complete, requiring several (lengthy[12]) saves between screens, and that users had to close the main ticketing window to return to the introductory window to enter another ticket. Users would prefer that data entry be handled on one page, with one save.

Because of the embedded sequence of data retrieval and validation, EFCL could not be cost-effectively modified to reduce number of pages or the number of saves. Looking forward, it would be valuable to gain efficiencies in both of these areas, although placing all options on one interface is not the end of the solution, as that would a) exponentially complicate page code and b) not inherently reduce the number of step by step saves required.

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service is available but, at the time of this writing, cable providers would not able to service the Marine Unit because user load was already to heavy for existing lines. ISDN is an option. [Footnote to a footnote: the Ft. Bragg Marine Unit got cable internet service as of Mar 10, 2004. Caito Fisheries reports that they were told they would have to pay to extend the physical line in order to get this same service.]

[12] See section 7.10 for details on the cause and impact of slow system performance.

The main ticket interface was modified to include an "Enter New Ticket" button, allowing users to move directly from one ticket to the next should they frequently enter more than one ticket at a time.

2. **Keyboard / Keystroke vs. Mouse Based Navigation**

    Dealer personnel found it difficult at times to navigate between pages and from field to field, an extremely common issue when crossing over from PC to web applications. They were working to overcome their pre-existing habits for navigating around their internal applications, including the patterned use of DOS-like keystrokes, Tabs, Enter, arrow, number pads, and Alt, Shift or Function keys. For example, on their systems, the Enter key moves from field to field, while, in web conventions, the Tab key moves from field to field and the Enter key (or a mouse-click) submits forms.

    EFCL generally follows web conventions, with some exceptions. For the case study, users were educated to use the Tab key to move from field to field; in turn, EFCL was easily customized to start at the first required field, move only to required fields with Tab entry, and consistently use the Enter key to submit forms. Almost all need for mouse clicks for navigation, drop-down list selection, and form submission was replaced by learning the keystroke options available, by default, as web conventions.

3. **Visual Design and Off-screen Elements**

    At an 800 by 600 screen resolution, important page components are off the screen, even if a window is maximized. Off-screen items include Save / Continue / Close buttons, search confirmation and search results, occasionally menu options. Lack of visibility of these items caused hesitation in new users; further, both horizontal and vertical scrolling was a regular frustration, even more so for users most comfortable with keystroke input. 800 by 600 is still a widely supported screen resolution and the preferred resolution of Caito Fisheries data entry personnel.

4. **Assorted Consistency and Standards, Web Conventions**

    It was not uncommon, particularly in administrative interfaces, for Save buttons to appear with no Close or Cancel buttons. As previously mentioned, Enter buttons were not always enabled to submit forms. Search results were returned with no record counts, though on the good side, cases where no results where found were clearly documented. Search criteria were erased upon submit, requiring users to re-enter criteria when search results were not what was intended.

5. **Error Prevention and Recovery**

    Unfortunately, if a mistake was made in initial vessel selection and ticket number, users could never change the vessel name or number and could not re-enter the ticket with the same number. There was no workaround to this. Users also requested that the main ticket screen, if closed, would warn if changes had been made– a common application feature. The proper approach would have been very time-consuming to implement on the page as written, but was partially addressed by ensuring that any movement to a new ticket automatically saved changes, and that closure of the main ticket window warned of loss of changes (as a default, whether or not changes had been made). This approach would not suffice for a production system.

    In addition, EFCL's system timeouts did not seem to be based on a period of inactivity or even a determinable period of logged-in time; timeouts occasionally kicked users out of the system in the middle of ticket or a save, without warning; input and changes were lost. The 15 minute default timeout (of the web serving

platform) was overridden on pages by a timeout of 60 minutes, but this did not prevent all timeouts or connection errors.

6. **Additional Issues**

Suggested improvements include a clearer hierarchy of headers (differentiated in size from main text), more consistent and descriptive browser page titles, and better cueing as to what users can, should, and are permitted to do within an interface – visually indicating which fields are required, for example.

The cumulative affect of these and other issues was that EFCL appeared incomplete and did not instill confidence in users. As stated in the beginning of this section, though, many usability issues could be easily remedied.

7.12 System Administration, Deployment And Maintenance Considerations

7.12.1   USER ADMINISTRATION

For the pilot, the CDFG agency was created, with 4 users: 1 fish dealer user, 1 biologist manager, and NWFSC and CDFG project leads with both data admin and biologist manager roles. The system instance had one super-admin, a role which is used to assign custom reports to an agency.

During the case study, EFCL's user roles worked very well to control access to data in a manner which suited California's ticketing environment. However, looking towards a large scale production implementation, certain aspects of user administration could become cumbersome. userIDs must be all digits and must be unique; unique userID numbers are not generated automatically, and data administrator must manually pick unique IDs. As the number of users grow, the awkwardness of this approach grows.

Passwords (PINs) must also be all digits, 8 digits long. Passwords with only digits are widely considered to be insecure with regard to password hacking programs; the addition of letters greatly improves password security. Additionally, EFCL PINs cannot be reset or changed by users, nor set to an automatic time-out schedule.

Further, there is no mechanism in EFCL to support the concept of user groups, and to globally configure access permissions to groups. For example, a team of users, all working for a dealer and with access to the dealer's data in the existing process, cannot share data from EFCL as a matter of course; data flows between individual userIDs. One user's permissions cannot be changed without changing the permissions of a specific (and hard-wired) user role, which again, must be implemented on a page by page basis. New user roles would require page by page development.

The secure and consistent implementation of business rules via user roles and page code is wholly dependent on the web developer. This was a design decision to allow agencies to customize EFCL without requiring Oracle database or Oracle experience. In practice, however, it adds a considerable level of complexity to system support and modification.

7.12.2   DATA ADMINISTRATION

User interfaces for data administration were rarely used, though their presence would allow a data administrator with no Oracle or database experience to effectively and centrally maintain reference data.

The majority of setup and reference data was batch loaded directly to the database from flat file exports created from the CDFG production database, for the fish dealer, for a 1 year historical period. Notable successes or exceptions to EFCL's intended data administration included:

Vessels – EFCL requires a vessel name and Coast Guard Number (CGN); state registration or DMV numbers are optional. For California, vessels are identified through their state registration number. Consequently, vessel CGNs were replaced by state registration numbers.

Participants – This should have included all fishers and vessel owners expected to land. For the pilot, all fishers/skippers and vessel owners were not loaded as participants; see permits.

Permits – In EFCL as originally designed, each vessel must be mapped with at least one participant who holds a Limited Entry Groundfish permit and at least one fisher/skipper participant who holds a state fishing license. Many-to-many relationships are permitted. This allows the system to populate and validate fields regarding federal permits and skipper licenses based on vessel ID. For the pilot, this had to be completely circumvented to allow for blank or multi-format permits. A separate table was created with one and only one historical relationship between a vessel, a skipper, and a state or federal permit. While tickets retained whatever permit and skipper information was entered, a default groundfish permit also had to be assigned "behind the scenes" to accommodate many of EFCL's other features.

Reference Codes – Ticketing interfaces did not seem to utilize certain database stored reference codes. So, the database reference codes were circumvented, and ticketing interfaces re-written with JavaScript validation for California gear codes, dealer size codes, condition codes, and a personal use flag.

Market Categories – Regional configuration of market categories worked very well, though they remained unmapped with limit categories and thus, formal quota reports.

EFCL's data administration interfaces exhibited same usability issues as ticketing interfaces, at times, more so. Problems included off-screen options, difficulty moving from one item to the next, lack of search and sorts capabilities, lack of cueing as to what was required, in some cases lack of validation, and lack of system-generated identifiers for items that an administrator could not be expected to keep unique from their own memory.

7.12.3   SECURITY AND PRIVACY

The security of communications between browser and server was fine for the pilot, though in a production system the HTTPS protocol with Secure Socket Layers (SSL) would need to be configured for the level of security (encryption) widely adopted for any sensitive data. As explained in section 7.12.1, user PINS may not be as secure as current expectations. Also as stated in section 7.12.1, the secure implementation of user roles on a page-by-page basis is only as good as the knowledge of application developers and their interpretation of implicit business rules. A more consistent, secure and flexible data access paradigm would likely be delivered through database level permissions

Other aspects of system or data security, such as firewalls, networks, connection strings, backup and restore procedures, were not examined.

7.12.4   PLATFORM, ARCHITECTURE AND TECHNOLOGIES

Platform, architecture and technologies were examined in terms of a) whether they best provide functionality and b) the ease with which they could be maintained, either

by the developing or adopting organization. With regards to dealer ticketing, we were concerned with EFCL's database and the web application components.

Native Platform Support

CDFG's preferred database platform is Oracle 8i. In that respect, EFCL's Oracle database structure and stored procedures could be almost instantly ported to CDFG's environment.

CDFG's web programming platforms include Oracle Forms and Java Server Pages, on a Linux web serving platform. Most web development would be handled by shared or part-time contractors with experience in these platforms and languages. In comparison, EFCL's web application is based on Active Server Pages (ASP 2.0), requiring the Microsoft IIS web serving platform.

A great many web programming languages share commonalities in function, syntax and database access paradigms. As such, experienced web developers can usually read and maintain code regardless of their preferred programming language. It is unnecessary (and outside of the scope of this document) to discuss which combination of current web technologies are the superior with regards to portability, expandability, customization, performance, and security. We can, however, safely assume two things:

♦   Some aspects of the system would require modification to be production ready. Additionally, some of EFCL's 1998 components would have to be upgraded to take advantage of current technologies for browser compatibility, performance, data exchange, security, and web application configurability.

♦   Modification or upgrade aside, the best platform is generally the acquiring organization's native platform. EFCL is not built nor delivered through CDFG's native platform, and would require the purchase, installation and support of a non-native web serving software and a development environment.

One positive aspect to CDFG's development environment is that their browser standards (Internet Explorer IE and Netscape, versions compliant with CSS2 standards) are higher than those EFCL was originally developed for (IE 4.0 and CSS1). Both dealers and fisheries technicians could reasonably be expected to have or download these more current browsers. This would make visual design and maintenance control much easier for anyone grooming the system.

Platform Alternatives: PC Software, File Uploads, and Hybrid Systems

EFCL offers only one way to collect fish ticket information, and that is through direct entry of tickets through its web application. Performance issues hampered the viability of this approach.

There are alternatives to a web-based ticket entry platform, including PC software or some method of "file upload". For each alternative, there are advantages and disadvantages related to performance, user resource requirements, deployment, maintenance and upgrades, and in some cases, operations.

PC Software – PC software designed for e-ticketing could be expected to have the greatest advantage in performance. The software client would probably be communicating with a local "server" application and datastore, and so, should respond at a speed comparable to any software the user is currently familiar with. More importantly, the software's datastore would allow tickets to be stored locally and transmitted back to an agency in regular batched intervals (as opposed to one by one). The local datastore allows ticket entry to continue even if there is a communication outage, and batch transmission is typically much quicker, regardless

of the user's communication resources (phone line, dial-up or high-speed internet connection).

The disadvantage to PC software lies in the hurdles it imposes on deployment, maintenance and upgrades. Most (but not all) desktop applications are platform (i.e. operating system) dependent, and must be delivered in as many versions as there are user platforms. Each user would be required to install and configure new versions. Further, these PC-based systems often require the dealer to perform aspects of user and data administration themselves, opening the door, in some cases, for reference data values to become out of synch with those centrally maintained by the agency. These issues are compounded the greater the number of expected users and the frequency by which software (or data) updates must occur.

Web-based Applications – Web systems are inherently easier to administer, maintain, and upgrade, across a variety of user platforms, with little or no impact on the user. Any number of web programming languages could be used. Changes made to the web application or its data would be instantly reflected to all users. Users on almost any operating system require only a designated web browser(s), many of which are freely available.

The disadvantage, of course, is that web based applications require constant communication with a web server, and so the user's internet connection speed will impact application performance. Another concern is that a communications outage will make ticket entry impossible. The impact of communication speed can be mitigated by optimizing web applications. The usability of a web application, in terms of performance, should be considered in the context of whether a user is using the application for one or two tickets at a time or a limited number per day, or trying to complete large volumes of tickets at once.

File Upload Utilities – File upload utilities would allow the submission of data files (produced from dealer accounting systems or specialized e-ticketing software or some other means) to the agency via FTP or HTTP protocols or email. Data files-most likely, simple plain text files- would have to adhere to a standardized agency format. File upload capabilities would be, for the most part, platform independent, but would require the dealer to take steps to ensure his or her output is in the required format and, should that format change, to modify his or her systems to adhere to the new format.

The advantage is that, beyond establishing the format for data files, little development effort is needed on part of the agency. This is a batch transmission, so performance should be of minor consequence. The challenge is to determine whether dealer or client systems could generate the proper data (off-load wet weights, for example), and that fully electronic files could satisfy any signature or hard-copy requirements. Of course, the signature and hard-copy requirements apply to other platforms as well.

A disadvantage is that file uploads – if offered as a one-way means of transmitting tickets to an agency, without the support of actual fish ticketing applications – wouldn't offer means for dealers or fisheries technicians to review or modify data, or to access the production data which results from agency processing.

Other Options and Hybrid Systems – Other options include handheld devices, supporting web or software applications, which could be taken to the dock, used to record landing data, and (with specialized hardware) may even record signatures (much like UPS).

Obviously, a hybrid system would offer one or more of these platforms, at the cost of added complexity and support. It is useful to note that the platform or application used to collect ticket data from dealers need not be the same platform or

application used to validate data or to used to allow dealers, fisheries technicians and agency staff features to review and groom data.

7.13 Other e-ticketing Initiatives

At the time of this writing, there were several other e-ticketing initiatives in place or planned for other regions in the United States. While a formal literature review or systems analysis was not part of the EFCL pilot, project leads did perform a cursory survey to determine if these initiatives' scope or platforms might augment the observations drawn from the EFCL pilot.

Two systems are mentioned here, both NMFS sponsored or affiliated. The information presented is drawn from some public sources and informal phone conversations, and should be treated as such. Questions regarding this information should be directed to the respective agencies cited.

7.13.1   SAFIS, AN EAST COAST INITIATIVE

NMFS Northeast Region, in coordination with the Atlantic Coast Cooperative Statistics Program (ACCSP), is providing the Standard Atlantic Fisheries Information System (SAFIS) e-ticking application to east coast states from Maine to Virginia and North Carolina.

SAFIS is web-based dealer ticket entry system built on Oracle Forms. The web forms submit data to NMFS NE, where it is validated and groomed slightly, then on to both the ACCSP data repository and state managed information systems. Dealers who submit data through SAFIS must adhere to the strictest of two requirements: their individual state reporting requirements, or federal reporting requirements. SAFIS will replace IVR system (weekly phone-in reporting for quota species management). SAFIS is one of three e-ticketing options available to east coast states: ACCSP also accepts feeds (as text files) via a web-based file upload utility, or through transfer of files (through phone, likely FTP) from dealers' internal accounting systems.

SAFIS is slated for limited production deployment in May of 2004. The development and implementation of this system is driven by Amendment 13 to the Fisheries Management Plan; details can be found at http://www.nero.noaa.gov/ro/doc/frdoc/04edrfr.pdf. All dealers are now required to report purchase or receipt of catch electronically, and daily, and mapped to the trip level[13].

This initiative has several implications for the EFCL pilot. First, that SAFIS' functional scope is concentrated on dealer ticketing. Second, that for a coast-wide solution, a web platform was chosen. Third, that the platform happens to be one of CDFG's native web development platforms. Fourth, that SAFIS is not the only means for dealer electronic data submission. And lastly, that Amendment 13 provides a precedent for the types of operational and regulatory changes necessary to successfully implement an e-ticketing solution.

7.13.2   ERV2 AND RELATED ALASKA INITIATIVES

NMFS Alaska Region, in coordination with the Alaska Department of Fish and Game, has required use of the ERv2 system for shore side dealers for a couple of years.

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[13] Dealers are held to this requirement based on their size or volume of fish; smaller dealers will be given a year to comply.

ERv2 is PC software built with Visual Basic. A system summary from the website at http://www.fakr.noaa.gov/er/default.htm includes:

"The ER system replaces a paper-based system of recordkeeping and reporting that was implemented in the late 1980's. This system required vessels and processors to maintain paper logbooks detailing fishing activity and catch. Processors were required to summarize the logbook on a weekly basis and fax a weekly production report (WPR) to NMFS for entry into the database. The ER system consists of two principal components. The ER Client software is used by personnel on a vessel or at a shore side processing facility to enter data and transmit data to NMFS. The ER Host software runs at the NMFS Alaska Region office in Juneau, Alaska. The ER Host system receives and logs transmitted files, validates the data, loads the data into an Oracle database, and sends a return receipt report to the vessel or processing plant informing them of the status of their submission. Use of the electronic report is required of all shore side processors accepting groundfish from AFA-eligible vessels."

ERv2 is one of several paper and electronic reporting methods in place in Alaska, reflecting the unique scope of Alaska fisheries and the necessity to collect data to the requirements of more than one management agency.

Most pertinent to observations drawn from the California pilot is that there is a proposal to replace ERv2 and other hardware, software and paper systems with an integrated data collection system that covers both logbooks and landing receipts. The scope of the proposed Alaska system is similar to the comprehensive scope and intent of the EFCL prototype system. While both system scopes are much larger than the California needs stated as part of this pilot, the technical, operational and regulatory analysis currently underway in Alaska is a much more comprehensive version of this pilot's preliminary analysis. Interestingly, Alaska's analysis closely parallels that which underpinned the original design of the EFCL system.

8 CONCLUSIONS

The California pilot of EFCL's electronic fish ticketing features was a valuable opportunity for system sponsors and potential acquirers to explore the usefulness of the prototype system within California's fish ticketing environment. This section summarizes the perceived pros and cons of the EFCL system as an e-ticketing solution, closed by a discussion of a few overarching considerations likely to shape California's e-ticketing strategy.

8.1 EFCL Pros and Cons

EFCL showed potential as an e-ticketing solution in many respects. With a minor to moderate development effort, the system stands to offer:

- **Support for required functionality** – features include ticket entry, ticket printing and signing, ability to finalize and officially hand-off to marine units (CDFG custody), and ability to collect CDFG required data in California tailored codes.

- **New and more efficient ways for fisheries technicians to review and edit tickets**.

- **Improved timeliness of data and quota species management processes** – with the understanding that data delivered may need additional validation.

- **The ability to provide secure, continued access to data to the fishers and dealers who generated it.**

However, we recognized that the system as piloted would require major development to address certain key issues, such as:

- **Slow web performance** – a factor of the dealer's dial-up internet connection, compounded by the multiple saves required for EFCL ticket validation.

- **Inflexible permit requirements.**

- **Limited reduction in data errors** – as implemented in the case study, there would be an undetermined tie-in or replacement of existing validation processes, leaving data prone to the same errors as before. New business rules, and new means of preventing, detecting, or correcting tickets would be required prior to production implementation.

These immediate and major development needs are the most prominent disadvantage, compounded by the fact that the system would:

- **Require ongoing and non-native platform support.**

- **Provide no foreseen reduction in overhead.**

8.2 Solution Independent Considerations

In order to successfully position itself for large scale evaluation or implementation of an e-ticketing solution, CDFG (in concert with all stakeholders) will have to tackle a number of issues. Many of these issues were clearly visible long before the California pilot, but the experience added some topic depth with bearing on CDFG's next steps.

Dealer and Marine Unit Computing and Communications Resources – One simple task, already begun as part of the pilot, is to establish the number and distribution of users with the resources necessary to participate in e-ticketing. That is, the percentage of users with or without computers, and the percentage of users

with or without access to high-speed internet connections (as compared to the number of users currently *utilizing* available connections). For those in areas where high-speed connections are not available, the approximate timeframe in which they should become available. Additionally, the most common operating systems, and the number of fish dealerships (and marine units) which already collect some form of landing or ticket data in internal software systems.

These measurements will help guide decisions regarding target scope of deployment, potential for tie-in with existing systems, most appropriate platform(s), and the timeframes in which CDFG could expect users to participate in e-ticketing or become compliant with any new regulations.

New Data Expectations and Business Rules – The majority of ticket data requirements are well defined and could be easily transferred to any e-ticketing solution. There are, however, many opportunities for improved data accuracy and completeness, possibly hand-in-hand with a reduction in manual validation overhead. If these improvements were to become part of an e-ticketing strategy, new business rules would have to be translated into a combination of programmatic logic and operational changes.

For example, should CDFG move to capture more detailed information regarding area fished, the programmatic logic necessary to validate this data's input would be very simple; the larger part of the challenge would be communicating the changed expectation to fishers and dealers. Some new data expectations would have negligible impact on logic or operations, others would have broad implications. Pertinent topics include:

♦ under what circumstances, if any, should blank data be acceptable, and what data would be subject to business rules unique to a fishery;

♦ whether it is important to capture both state and federal permits upon ticket creation, and how to validate that the permit supplied is appropriate to the fisher, vessel, or catch involved;

♦ whether the system should track quota consumption, and how that information could be provided to fishers, dealers, and fisheries technicians;

♦ whether and when to allow fisheries technician changes to tickets, whether to track these changes, and how to determine when data should be considered official and final for specific purposes;

♦ where the bulk of business rule enforcement should take place. That is, what types of error prevention *upon data input* would be possible (and operationally tolerable), what types of error detection *after data is accepted* would be necessary. How much of manual inspection can and should be replaced, and who should share in data correction.

Regulatory Modifications – As mentioned many times, true e-reporting is moot until the regulation that fishers sign individual paper tickets is lifted or modified. CDFG must determine how an electronic system can satisfy the intent of this regulation. Further, how same-day landing receipt requirements and other processing timeframes would translate into an electronic workflow, and how that workflow would be guided by modifications to FG 8043 and other sections of the California Fish and Game Code. Amendment 13, on the east coast, sets forth a precedent.

System Platform(s) and Development Strategy – As discussed in section 0, e-ticketing could be accomplished through web applications, software applications, file upload utilities, or a combination thereof. CDFG must determine which platform

would offer the greatest return on investment, based on existing or near-term computing resources, development resources, and the system features which would translate into the greatest efficiencies in data processing. It is not within the scope of the pilot to recommend a platform, development strategy, or a required set of features. Questions remain as to whether a system (and business processes) should put emphasis on: new ways to help dealers and fishers provide more complete data, new ways to support fisheries technician edits, new ways of leveraging native CDFG systems and possibly dealer systems, new ways of automating error detection, or a combination of some or all.

Education, Awareness, Incentives, and Training – One of the most important parts of an e-initiative would be to work with potential users (fishers, dealers, and marine unit personnel) to determine their awareness of and reception to e-solutions, provide tangible incentives for system use, identify training needs, and help everyone mitigate the time, staff and resource investments necessary to successfully participate in the initiative, at least in its early stages.

Additional Costs and System Support Needs – CDFG will have to absorb many costs to implement an e-reporting solution. System users may also have to absorb certain costs. Costs could come from outright system purchase and licensing, the purchase of non-native hardware and software items necessary to host the system, outsourced or in-house development, ongoing technical support, user support, training and outreach. Further, if CDFG chose to host a system itself, then CDFG would have to absorb the additional costs (and responsibility) of maintaining a system uptime of 24/7 or close to it, with provisions for handling system downtime. These costs should be quantified as part of a large scale evaluation or implementation effort.

In comparison to costs, it is difficult to quantify the *value* of an e-ticketing system in terms of improved fisheries management. However, it should be possible to quantify potential cost savings in terms of labor efficiencies, reduced staff needs, and reduced materials needs. These savings could help offset the cost of system implementation and may indicate the timeframe necessary to realize a return on investment.

This concludes this summary of the California EFCL pilot.