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THE DESIGN AND ANALYSIS OF SALMONID TAGGING STUDIES IN THE COLUMBIA BASIN

VOLUME X: INSTRUCTIONAL GUIDE TO USING PROGRAM CAPTHIST TO CREATE SURPH FILES FOR SURVIVAL ANALYSIS, USING PTAGIS DATA FILES

Instructional Report

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VOLUME X

INSTRUCTIONAL GUIDE TO USING PROGRAM CAPTHIST TO CREATE SURPH FILES FOR SURVIVAL ANALYSIS, USING PTAGIS DATA FILES

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Preface

‘Project 89-107, Epidemiological Survival Methods, was developedto provide statistical guidance on the design and analysis of PIT-tag survival studies to the Northwest fisheries community. This study determined the statistical feasibility of conducting PIT-tag smolt survival studies, analytical capabilities for analyzing the tagging experiments, and recommendations on-study design. As PIT-tag capabilities developed and research interests increased, the project has been instrumental in maintaining the statistical capabilities for designing and analyzing tagging studies as research objectives have expanded. This report describes program **CaptHist,** a data processing utility for converting raw PIT-tag data from PTAGIS into SURPH data input format for use in survival analysis.

Executive Summary

The utility CaptHist was developed to act as a bridge between raw PIT tag data found in PTAGIS and the statistical survival **analysis tool SURPH**. The **raw** data from PTAGIS is in a form that must be pre-processed before it can be used as input to SURPH. A user's guide for **CaptHist** is presented here.

This work was conducted under contract **#DE-BI79-90BP02341** to Bonneville Power Administration. The goal of this task and project is to develop and disseminate the technologies needed for the design and analysis of Columbia Basin **salmonid** survival studies. This report describes an utility to streamline the conversion of PTAGIS raw data file into formats ready for survival analysis using program SURPH. 1.

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Introduction

The SURPH program is a valuable, tool for estimating survivals and capture probabilities of fish outmigrations on-the Snake and Columbia Rivers. Using special data files, SURPH computes reach to reach statistics for any release group passing a system of detection sites.

Because the data must be recorded for individual fish, PIT tag data is best suited for use as input. However, PIT tag data as available from PTAGIS comes in a form that is not ready for use as SURPH input.

SURPH requires a capture history for each fish. A capture history consists of a series of fields, one for each detection site, that has a code for whether the fish was detected and returned to the river, detected and removed, or not detected.

The data as received from PTAGIS has one line for each detection with information such as fish identification (id), detection date and time, number of coil hits and detector coil id's, etc. Because an individual fish may be detected at several coils within a detection site as well as at several detections sites, each fish is often represented by multiple lines in the PTAGIS data file.

For the PTAGIS data to be usable by SURPH it must be pre-processed. The data must be condensed down to one line per fish with the relevant detection information from the PTAGIS file represented compactly on each line. In addition, the PTAGIS data file coil information must be passed through a series of logic algorithms to determine whether or not a fish is returned to the river after detection.

Program CaptHist was developed, to properly pre-process the PTAGIS data files for input to program SURPH. This utility takes PTAGIS data files as input and creates a SURPH data file as well as other output including travel time records, detection date records, and a data error file. **CaptHist allows** a user to, download PTAGIS files and easily process the data for use with SURPH.

CaptHist User's Guide

SURPH Input Files

SURPH input files consist of header information followed by capture histories for each-fish in the release group being studied. Fig. 1 shows an abbreviated example of an input file. The file has two basic parts: the header and the data. For a description of the SURPH data file header, consult the SURPH manual, section 5.3.

This document will focus on the data segment portion of the SURPH data file because this is where program **CaptHist** is most valuable. The data segment of the SURPH file consists of capture histories surrounded by the keywords "data" and "enddata".

In the example shown in Fig. 1, fish were released above Lower Granite Dam and then detected (or not detected) at detections sites on the Snake and Columbia Rivers. The capture history consists of a PIT code followed by 5 fields: the first field for the point of release, the next three fields representing recaptures at Lower Granite, Little Goose, and Lower Monumental dams,. and the final field handling any other downstream recaptures. A field can have any one of several values with meanings as follows: Oif not detected, 1 if detected and. returned to the river, 2 if

detected and removed from the river, and, optionally, 3 if detected but of unknown' active status.

In the example, the fish with PIT code 222A4E2254 was released and then detected at Lower Granite and Little Goose, was known to be in the river after Little Goose but was not detected again.

Figure 1: SURPH Input File

```
Data
sample
      \
npop 1
nper 4    \
                \
ntag              \  See SURPH documentation for explanation
9 0 0 0           /
                 /
full_hist       /
                /
idlen 10       /
data
222A4E2254 1  1 1 0 0
22294C637A 1  0 0 0 0
2214636243 1  0 1 0 0
2214670160 1  0 0 1 0
221464261D 1  0 0 0 1
22142A006D 1  0 0 1 0
2214167A3B 1  0 0 1 0
22140C0306 1  0 0 1 1
221339587C 1  0 0 0 1
enddata
```

CaptHist is especially useful in creating the capture histories in the second part of the data file. These'capture histories represent the record of the fish through the'river system.

PTAGIS Data Files

The raw data from PTAGIS that corresponds to the capture history in the previous example is shown in Fig. 2. The columns in order are: tag file id, PIT code, detection site, detection date and time, number of detector coil reads, coil id 1, coil id 2 (XX indicates none), and travel time from release.

To translate this raw data into a SURPH data file, we must look at both the detection site

code and the coil ids. The detection site code will tell us where the fish is being detected. In this example we have three detection site codes for two detection sites: GOJ indicates Little Goose Dam; GRJ and GRX indicate Lower Granite Dam.

Next we look at the coil id's to determine what route the fish took through the detection site (i.e. whether or not the fish ended up back in the river). The coil id 2A at detection site GRJ indicates the "separator" detector, the first detector a fish would pass at Lower Granite Dam. Coil ids 3A, 36, and 38 indicate the "diversion" detector which means the fish was diverted back to the river. The proper capture history value for this fish would be a 1, detected and returned to river.

The GRX detector hits are ignored. Certain coil id's associated with the GRX detection site code would indicate a removal and cause a 2 in the capture. history, but these codes indicate a return to river, which has already been indicated.

The GOJ detection site hits would be dealt with in a similar manner.

Figure 2: Sample PTAGIS data

```
RNI96102.AA1 222A4E2254 GOJ 15-may-1996 11:50:57 1 48 XX 32.95
RNI96102.AA1 222A4E2254 GOJ 15-may-1996 11:50:57 1 4A XX 32.95
RNI96102.AA1 222A4E2254 GOJ 15-may-1996 11:50:58 2 4C 4E 32.95
RNI96102.AA1 222A4E2254 GOJ 15-may-1996 11:51:07 1 A6 XX 32.95
RNI96102.AA1 222A4E2254 GOJ 15-may-1996 11:51:08 2 A8 AA 32.95
RNI96102.AA1 222A4E2254 GOJ 15-may-1996 11:51:13 1 56 XX 32.95
RNI96102.AA1 222A4E2254 GOJ 15-may-1996 11:51:14 2 58 5A 32.95
RNI96102.AA1 222A4E2254 GRJ lo-may-1996 23:04:17 1 2C XX 28.42
RNI96102.AA1 222A4E2254 GRJ 10-may-1996 23:26:01 2 36 38 28.43
RNI96102.AA1 22219432254 GRJ lo-may-1996 23:27:01 1 3A XX 28.44
RNI96102.AA1 222A4E2254 GRX lb-may-1996 23:22:22 1 74 XX 28.43
RNI96102.AA1 222A4E2254 GRX IO-may-1996 23:22:22 1 76 Xx.28.43
RNI96102.AA1 222A4E2254 GRX TO-may-1996 23:22:26 1 80 XX 28.43
RNI96102.AA1 222A4E2254 GRX 10-may-1996 23:22:26 1 82 XX 28.43
RNI96102.AA1 222A4E2254 GRX lo-may-1996 23:22:26 1 86 XX 28.43
```

This PTAGIS observation data is a detailed record of the passage of a fish through the system. The columns are tag group, PIT code, observation site, observation-date, observation time, number of coils hits, first coil, second coil, and travel time.-'

The SURPH data pre-processor CaptHist

Needless to say, repeating the above exercise for thousands of fish would become tedious which is why we developed a data handling tool to do the work, **Program CaptHist takes** data in the form of raw PTAGIS files and runs the necessary coil and detection site recognition algorithms to create the capture histories for use as input to SURPH.

In addition **CaptHist** checks for errors in the data; For instance, a fish detected downstream "before" being detected upstream. These errors are removed from the output and recorded in a separate error file.

Other outputs include a travel time file that contains travel times to each detection site for each fish, a detection date file that contains detection dates in day-of-year to each detection site for'each fish, and a coil hit file that counts the number of coil hits at each site for each fish.

Program CaptHist was designed to work on the Snake and Lower Columbia Rivers. The program can be extended to work on other systems. All that is needed is some site **specific** information for the new system. This information is added to the program by editing the source code and so any modifications of this type must be made by the Columbia Basin Research staff.

Using CaptHist

Two basic data files are needed for input to **CaptHist**: **an** observation (detection) file and a tag file. In addition a mortality file, if available, **allows CaptHist to** remove any fish that are **known** moralities, and a release **date** file **allows CaptHist** to create the travel time file (Travel, times given in PTAGIS data files are sometimes inconsistent due to different methods of recording). These release date and **mortality** data are readily available through **PTAGIS**.

Observation Files

The example in Fig.2 shows the proper format for the observation **file.** This file would contain such **data for** all fish in the release. The **file** must have exactly 8 columns with dates in the proper format. Currently **CaptHist** recognizes **both** dates in the **03-feb-** 1997 format and the equivalent **02/03/97** format. Any missing coil codes should be replaced by XX.

Tag files

Tag files give **CaptHist the** release information. Most importantly in survival calculations, the set of all fish released. This will be compared to detections to determine survivals. **Figure** 3 shows the proper format for a tag file. The columns are: tag file id, PIT code, species, rearing type, length, and tag session flag (with information on special circumstance related to the fish).

Figure3: Tag file format

```
RNI96102.AA1 2214167A3B 1 H 159 XX
RNI96102.AA1 22142A006D 1 H 138 XX
RNI96102.AA1 221464261D 1 H 114 XX
RNI96102.AA1 2214670160 1 H 118 I_I
RNI96102.AA1 2214636243 1 H 125 XX
RNI96102.AA1 22294C637A 1 H 167 XX
RNI96102.AA1 222A4E2254 1 H 178 XX
```

Tag file format columns as follows: tag group, PIT code, species, rearing type, length, tag session flag.

Mortality files

A file that simply contains a list of PIT codes, one per line, each representing a dead fish that was not released but whose PIT code is in the tag file.

Release files

A file with a tag file id, a release date, and a release time. An example of a release file is shown in Fig. 4.

Figure 4: Release file format

```
RNI96096.6A1 4/06/96 14:30:00
RNI96099.6B1 4/08/96 15:28:00
RNI96100.6C1 4/09/96 11:00:00
RNI96102.6D1 4/11/96 15:00:00
RNI96102.A11 4/12/96 13:00:00
```

Release file has 3 columns: tag group, release date, and release time!.

Downloading CaptHist

To run CaptHist you need a copy of the executable file. Go to the SURPH web page at http://www.cqs.washington.edu/surph/ and click on utilities; This page will have further instructions.

Running CaptHist

To test your copy, start with the following command from the DOS or UNIX prompt:

capthist -n

This should create a file called "chrc", a run time configuration file that is described at length below.

If you have downloaded the complete distribution you will have some sample data files for input to CaptHist: pwlhOl.obs and pw1h01.tag. Use the following command to create a surph input file:

capthist -Gpw1h01 -Ragr

This is the most basic way to run CaptHist. The -G flag tells CaptHist that the group prefix is pw1h01. CaptHist will search the data directory (defined in chrc, see below) for the file pwlhOl.obs and pw1h01.tag. Multiple groups are possible simply by giving multiple -G flags. The -R flag lets CaptHist know where in the system the fish were released, in this case upstream of, or "above", Lower Granite Dam (ie., agr).

The resulting capture history will have 5 fields. The first is the release field which is always one. The next field is the first detection site the fish will pass, namely Lower Granite Dam. Following are Little Goose Dam, and Lower Monumental Dam, and finally a catch-all field for any detections downstream of Lower Monumental at McNary dam, John Day dam, or Bonneville dam..

The fields in the surph file-are configured in the chrc file and may-include the above sites as well as the traps on the Snake River and-it's tributaries. See the discussion below on run time configuration for more information about how to do this option.

Run time configuration: chrc

Perhaps you do not want all five of the output files, or you would like to keep your data in one sub-directory and your output files in another. Or you would like to change-the fields that appear in the SURPH file. By editing the chrc file created in a previous example, you can configure CaptHist to your own needs.

The fields strings allow you to define capture history fields, the output switches allow you to switch certain files on or off, the directory configuration allows you to keep data and output separated, the file name configuration allows you to name the default mortality and release files (if. used), and the file name extension section allows you to define the extension names that work best for your system.

Fields strings

There are two sets of fields strings: main and last. The main fields refer to the fields in the capture history after release but before the final field. The last field is a catch all that will be one if the fish is detected at any one of the detection sites listed in the last fields string. These fields should be a comma separated list. For example, gr,go,lm specifies Lower Granite, Little Goose, and Monumental dams.

For a complete list of possible field names, see Appendix A.

Output file switches

Determine which of the output files are written: 1 to write, 0 to not write. See the section titled "Output Files" for more information on the content of the files.

Directory configuration

By default **CaptHist will** search for input files and write output files in the directory where it was run. To change directory for the input or output files, enter the name of the new directory here. This allows the feature of having two sub-directories of the directory that contains the **CaptHist** executable file, one for input and one for output to help keep your files organized. A '.' indicates the current working directory.

File name configuration

The mortality file and the release file are not necessary for a basic run. These files are used to check errors and to create the travel time output file. By default **CaptHist** searches the data directory (as configured above) for files of the name **all.mrt** and **all.rel**. You can change these default names here. In addition, if you wish to specify the names on the command line with a flag that is possible too. See the section titled "Command Line Flags" for more, information.

File extension configuration

Set the filename extension for both input and output files. For instance, the SURPH data file could be .surph, or on the PC platform .srh since three letters work better there.

Command Line Flags

Most of the specifics of a run are passed to the CaptHist program via command line flags or

arguments. These flags **tell CaptHist** what group(s) to look for, where the release was within the system, whether or not to check for errors, and other more esoteric considerations. Below is the entire list of flags along with explanations.

-c allows single coil hits

By default, if a fish is detected at only one coil at a given detection site, this detection record is removed because there is a good chance of it being an error. This flag allows you to include these if you desire.

-E indicates errors should be found and removed

Error checking is switched on with this flag .

-Freartype:

The rearing type. Same codes as used at **PTAGIS**.
W -> wild
H **->** hatchery
u **->** unknown
A->all

-Ggroup: where group is the obs file and tag file prefix

The name of the group of fish to **do the run** on. **If the** group **is** pwl **h01,** by default **CaptHist** will look for pwlhOl.obs and **pw1h01.tag** for input and all the output will be prefixed by this group (e.g. pw **1h01 .srh,** etc.) The filename extension can be changed using the "extensions" directives in the **chrc** file as explained in the section titled Run Tie **Configuration.** Multiple **-G** flags may be given.

-ircfile: use alternate runtime configuration file

CaptHist will read the named file for **configuration** instead of the default file **"chrc".**

-1 include length in surph file, remove zero length fish

This flag causes Cap&Iii to add length to the **SURPH** file as a **covariate** and in addition remove any fish with a zero length. **Otherwise** length is ignored,

-Mmortfile: gives the name of the moralities file to be searched for

This file will be searched for in the data directory **in** place of the default file **all.mrt.**

-n create new run time configuration file "chrc" with default settings

Create a default **chrc** for editing and **exit.**

-p set output prefix, used when multiple groups are given on command line

When multiple **-G** flags are give, the output file name prefix is ambiguous. By default the output files will be named composite.*. Use the **-p** flag to set it to something **specific.**

-rrelfile:

This file will be searched for in the data directory in place of the default file all.rel.

-RreleaseSite:

The point of release. This can either be a dam (e.g. gr), or upstream of a dam (e.g. agr). The following are valid release points. By placing the letter "a" in front of any of them, the meaning will be "above" (i.e. upstream of):

agr -> upstreamof Lower Granite
gr -> Lower -Granite Dam

If the fish are released at the dam an additional check is done so that only fish known to have entered the river below the dam (not transported or sampled) are included in the survival estimates. Otherwise the capture histories will look the same.

Not all release sites are allowable for each run. The release site must be one of the main fields as defined in the run time configuration file. If the main fields are configured as follows:

fields-main: gr,go,lm

The accepted release sites are agr, gr, ago, go, alm, or lm.

If the release site is not the first of main field, than the main fields up stream of the release site are not included in any of the output files. Program CaptHist does use the up stream main fields for error checking.

-s split input data to conserve memory.

If data files tie so big that CaptHist runs out' of memory, this flag can be set to conserve memory. Data files are split into smaller temporary files and then read in one by one, thus each data file is small enough (hopefully) to be loaded into memory for processing.

-t ignore fish found in obs tile that are not in tag file

This flag tells CaptHist to ignore any fish in the-detection file that is not in the tag file. This is convenient when a detection file contains observations from many release groups and you only want to look at one of them.

-Sspecies:

Set the species. By default this is set to chinook. The species codes are the same as the PTAGIS codes. They are as follows:

o->all
1 -> chinook
3 -> steelhead
4 -> sockeye

-U give 3 for unknown capture status

By default a fish gets a 2 for it's capture history if it is detected and then either known to have been removed or if its passage after the first detection is unknown. If the **-U** flag is given than the second group of fish with unknown fates receive a 3 in their capture history to distinguish them from the first group.

Output Files

surph file:

An example of a Surphfile is illustrated below for the case of a release above Lower Granite **Dam** with 4 downstream detection sites at Lower Granite, Little Goose, Lower Monumental and below Lower Monumental,

The meanings of the header fields is explained in the Surph documentation. The columns in this example are as follows:

column 1: PIT code
column 2: release
column 3: Lower Granite
column 4: Little Goose
column 5: Lower Monumental
column 6: **downriver** of Lower **Monumental**

-- start file --
Data

pw.1.H.01

npop 1
nper 4

ntag
1233 000

full_hist

idlen 10 .

data
7F7A250404 1 0 0 0 0
7F7A250402 1 1 0 0 0
7F7A250361 10 0 0 0
7F7A25034A 110 **0** 1
7F7A25033A 10 10 0
7F7A25032E 10 10 0

...
204B543F02 10 10 0
1F6E0C7077 10 0 10
1F6E0B2D3B 10 0 0 0
1F6E0A6B7E 1 10 0 0
1F6D763F3F 10 0 0 0
enddata
-- end file --

travel time file:

A fish may be detected several times at a dam. Here we record the travel time from release to the first detection at a given site along with the travel time from release to the last detection at a given site.

The first line in the file is the header giving information about the data that follows. The header for this file looks like:

pitcode gr go go lm lm mc mc jd jd bv bv

From the header we can determine that, for instance, the second and third columns pertain to Lower Granite detections. In the travel time file as well as the detection date file, the convention is that the first of the two columns pertains to the first detection at the site and the second pertains to the last detection.

The columns are determined by the field configuration given in chrc. Any field listed as either a'main field or a last field has two columns associated with it in the travel time file (and the detection date tile).

Here is an example:

-- start sample --

```
pitcode gr gr go go lm lm mc mc jd jd bv bv
22131C273C 0.000000 0.000000 0.000000 0.000000 9.758333
9.759027 0.000000 0.000000 14.148611 15.025000 0.000000 0.0000.00
0.000000 0.000000
22131C3661 0.000000 0.000000 0.000000 0.000000 8.398611
8.402777 0.000000 0.000000 -0.000000 0.000000 0.000000 0.000000
0.000000 0.000000
. 22131C5950 0.000000 0.000000 25.184027 25.793750 0.000000
0.000000 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000
0.000000 0.000000
22131D243F 0.000000 0.000000 0.000000 0.000000'0.000000
0.000000 19.367361 19.576389 29.576389 29.577777 0.000000
0.000000 0.000000 0.000000
2213232F29 0.000000 0.000000 x13.236805 13.242361 0.000000
```

```
0.000000 18.411111 18.744444 0.000000 0.000000 0.000000 0.000000
0.000000 0.000000
    2213261007 0.000000 0.000000 0.000000 0.000000 0.0000.00
0.000000 0.000000 0.000000 30.296527 30.297222 0.000000 ~0.000000
0.000000 0. 000000
    2213271B42 0.000000 0.000000 0.000000 0.900000 16.300000
16.302083 0.000000 0.-000000 0.000000 0.000000 0.000000 0.000000
0.000000 0.000000
    22.13293721 0.000000 0.000000 0.000000 0.000000 25.701389
25.716666 '0.000000 0.000000 0.000000 0.000000 0.000000 0.000000
0.000000 0.000000
    2213293B7D 0.000000 0.000000 0.000000 0.000000 33.355555
33.356944 0.000000 0.000000 0.000000 0.000000 0-.000000 0.000000'
43.291666 43.291666
    22132B0C6A 0.000000 0.000000 11.331250~11.336805.15.742361
15.745139 0.000000 0.000000 0.000000 0.000000 0~000000 0.000000
0.000000 0.'000000
```
-- end sample --

detection date file:

A fish may be detected several times at a detection site. Here we record the first detection date and 'the last detection date. All values- are in day-of-year with January 1 at noon being denoted 1.50 (as opposed to 0.50) A 0.000000 indicates no detection.

In the detection date file there are two columns for each of the fields configured-in the chrc file. These fields are given in the one line header of the file. The first column of the pair contains first detection date at the site, the second contains last detection date at the site.

-- start sample --

```
pitcode gr gr go go lm lm mc-mc jd jd bv bv
    22131C273C 0.000000 0.000000 0.000000 0.000000 113.300000
113.300694 0.000000 0.000000 117.690278 118.566667 0.000000
0.000000 0.000000 0.000000
    22131C3661 0.000000 0.00'0000 0.000000 0.000000 111.940278
111.944444 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000
0.000000 0.000000
    22131C5950 0.0~0000 0.000000 128.725694'129.335417 0.000000
0.000000 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000
0.000000 0.000000
    22131D243F 0.000000. 0.000000 0.000000 0.000000 0.000000
0.000000 122.909028 123.118056 133.118056 133.119444 0.000000
0.000000 0.000000 0.000000
    2213232F29 0.000000 0.000000 116.778472 116.784028 0.000000
0.000000 121.952778 122.286111 0.000000 0.000000 0.000000 0.000000
```

```
    2213261007 0.00~000 0.000000 0.000'000 0.000000 0.000000
0.000000 0.000000 0.000000 133.838194 133.838889, 0.000000
0.000000 0.000000 0.000000
    2213271B42 0.000000 0.000000 0.000000 0.000000 1'19.841667
119.843750 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000
0.000000 0.000000
    2213293721 0.000000 0.000000 0.00'0000 0.000000 129.243056
129.258333 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000
'0.000000 0.000000
    2213293B7D 0.000000 0.000000 0.000000 0.000000 136.897222
136.898611 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000
'146.833333 1461833333
    22132B0C6A 0.000000 0.000000 114.872917 114.878472 119.284028
119.286806 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000
0.000000 0.000000
```

-- end sample --

error file:

When the -E flag is given on the commandline, CaptHist checks the data for any errors and outputs whatever error information it finds to a file. If no errors are found, the file will not be created.

The errors are broken up into errors that are removed and errors that are recorded but not removed. The second column has either a one to indicate that the error caused removal or a zero to indicate that the error is a warning only and the fish was not removed.

The error file has one line for each fish and is followed by a series of either ones or zeros. A one in a given column indicates an error of that-type has occurred, a zero indicates no error. A fish is recorded in the error file only if it has at least one error.

Here is a brief description of the error columns:

column 1: PIT code
column 2: removal status

column 3: duplicate tag in tag file (not implemented)
column 4: negative travel time
column 5: length of zero
column 6: Fish detected upstream after downstream detection
column 7: Fish detected upstream of release
column 8: mortality in observation file
column 9: mortality in tag file
column 10: wrong species
column 11: wrong rearing type
column 12: fish not known to be returned to river
column 13 no release date for fish

Lower Granite Coil errors;
column 14: Detection at diverter and sample
column 15: Detection at diverter and raceway
column 16: Detection at raceway and downriver
column 17: Detection at sample and downriver

Little Goose Coil errors:
column 18: Detection at diverter and raceway
column 19: Detection at diverter and sample
column 20: Detection at diverter exit and raceway
column 21: Detection at diverter exit and sample
column 22: Detection at raceway and downriver
column 23: Detection at sample and downriver

Lower Monumental Coil errors:
column 24: Detection at diverter and raceway
column 25: Detection at diverter and sample
column 26: Detection at diverter exit and raceway
column 27: Detection atdiverter exit and sample
column 28: Detection at raceway and downriver
column 29: Detection at sample and downriver

-- begin sample --

```
7F7A250313 1 0 0 0 0 0 0 1 0 0 0 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
7F7A247E7D 1 0 0 0 0 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
7F7A24763E 1 0 0 0 0 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
7F7A246741 1 0 0 0 0 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
7F7A1B7A1E 1 0 0 0 0 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
7F7A1B6D3F 1 0 0 0 0 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
7F7A1A2A5F 1 0 0 0 0 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
7F7A1A2406 1 0 0 0 0 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
7F7A1A1C5F 1 0 0 0 0 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
7F7A1A1B27 1 0 0 0 0 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
```

-- end sample --

coil file:

The number of coil reads at each of the detection sites is recorded in the coil file. The first line in the file is a header line that indicates the capture sites for the data. For instance, fish 2233445D63 was detected on 9 coils at Lower Granite Dam, 11 coils at Little Goose Dam, etc. As with the travel time file and the detection date file, the columns in this file are configured by the settings for "fields-main" and "fields_last" in the chrc run-time configuration file.

-- begin sample --

```
pitcodegrgolmmcjdbv
2233445D63    9  11  11    0    0    0
22333C5D2E    0   8   0    0    0    0
223335137C    0   0   8.   0    0    0
222A622B7D    0   0  11    0    0    0
222A5A5A76   10   0   0    0    0    0
222A4E2254    9   10'0    0    0    0
222A4D0856    0   0  11    0    0    0
222A4A3012    9   0   0    0    0    0
222A433E39    0  11   0    0    0    0
22295C470F    0-8      0    0    0    0
```

-- end sample --

Examples

Run **CaptHist** on pwlhOl.obs and **pw1h01.tag, tell CaptHist** that the fish were released above Granite and **check** for errors.

capthist **-Gpw1h01 -Ragr -E**

Program CaptHist will search the data directory (as configured in **chrc)** for the files **pw1h01.obs** and **pw1h01.tag. If** either of these files are not found, **the CaptHist will** exit. In **addition, CaptHist** will search the data directory for a mortality file and a release date file, by default **all.mrt** and **all.rel. Program CaptHist will complete** the run whether or not these files are found as the mortality and release date files are optional.

The -Ragr flag tells **CaptHist** to treat the fish as being released above Lower Granite Dam with that **being the first** detection site. The -E flag causes **CaptHist** to check for errors and to record them in an error iog file if any are found. For instance, if a fish is detected above the point of release, that would be an error. This would happen‘in the following scenario:

If the main fields are configured to be im, gr, go, and lm with the release site being agr, any detection at im would be an error. To include these fish as valid detections, the release site would have

to be aim. See the description of the error file above for a more complete description of errors.

Run **CaptHist** on a group of wild Steelhead.

capthist **-Gpw3w01 -Ragr -E -S3 -FW**

With the **-E** flag, fish of the wrong species are removed. The default species is chinook but with the **-S** flag with the 3 qualifier, the species has been switched to steelhead. No with the **-E** flag, any fish **that** is not a steelhead is removed. The **-F** flag with the W qualifier **tells CaptHist** that the fish are wild; by default the fish are taken to be hatchery fish (H).

Create **runtime** configuration file **"chrc"** and exit.

capthist **-n**

This creates the default **chrc** file which may then be edited for custom configuration.

Run **CaptHist** in split mode: splitting input data to use less memory.

capthist **-Gpw1h01 -Ragr** -E-s

This run will have the same results as the first example but the run will be done in a memory **minimizing** way **so** that files that very large **can be** handled. **The -s** flag tells **CaptHist to** break the input files into smaller files and then to work on each of these smaller tiles one at a time

Program CaptHist splits files so that fish are grouped by **PIT** code, taking the last n digits as the' matching criterion. By default the fish are sorted by the last digit in their PIT code. This can be **modified** to create small split files by taking the last two digits of the **PIT** code by adding a qualifier to the **-s** flag: **-s2.**

Feedback

For **additional** information, clarification or assistance in running program **CapthHist** contact Peter **Westhagen** at Columbia Basin Research, School of Fisheries, University **of** Washington **(email: china@u.washington.edu).**

Appendix A

Site name codes

b	v	Bonneville Dam DSM1 Subsample
cn		Challis Diversion North
cl		Clearwater River Trap Juvenile
gr		Lower Granite Dam Juvenile
im		Imnaha River Trap Juvenile
jd		John Day Dam Gatewell Airlift
lm		Lower Monumental Dam Juvenile
mc		McNary Dam Juvenile
pr		'Prosser, Juvenile (Chandler Diversion)-
ra		Redfish Lake Creek Trap A
r b		Redfish Lake Creek Trap B
sa		Salmon River Trap Juvenile
sn		Snake River Trap Juvenile