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Revised Web-based North Pacific Salmon Otolith Mark Directory

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Abstract

In 2002 Alaska Department of Fish and Game provided the Working Group on Salmon Marking with a public web site and database to document all salmon otolith marks generated and released in the North Pacific. A complete rewrite of this resource has been performed. This document explains shortcomings associated with the old system, improved features of the new system, and details of adjusted methods, data definitions and conventions required by the new implementation. A notable new feature is the ability for each jurisdiction to enter and correct their data from any location in the world through a web browser. A tool is included that allows marks to be referenced as either codes or as visual patterns drawn on the screen using a mouse. Database searching and reporting functions have also been improved. A comprehensive list of basic data validation rules enforced by the new application is provided. A proposal for an unambiguous method for assigning codes to mark patterns is provided under the name "Uniform Hatch Code."

Introduction

The need to internationally share details of salmonid otolith marking was documented in 2001 (Urawa, *et al*.). North Pacific research surveys were recovering salmon specimens having induced otolith marks. Marks had been successfully used for stock management and research near-shore, where local records detailing original marking were readily available. However, there was no comprehensive source of North Pacific mark data that could be used to help identify the origin of high seas recoveries. Furthermore, because there was no coast-wide coordination of marking, duplicate patterns were being generated among the different jurisdictions. Duplicate marks seriously diminished the ability to classify high seas recoveries.

Hatchery salmon otolith marking has steadily gained popularity over the past thirteen years. Its use has increased, both in the absolute numbers of fish marked, as well as in the proportion of all hatchery releases it covers. In 2004 over 5 billion hatchery salmon were reported released by NPAFC participants. About 1.6 billion of these fish had marked otoliths (Figure 1). Most marks were thermally induced. However, salmon marked using other techniques, such as chemical marks, are being released.

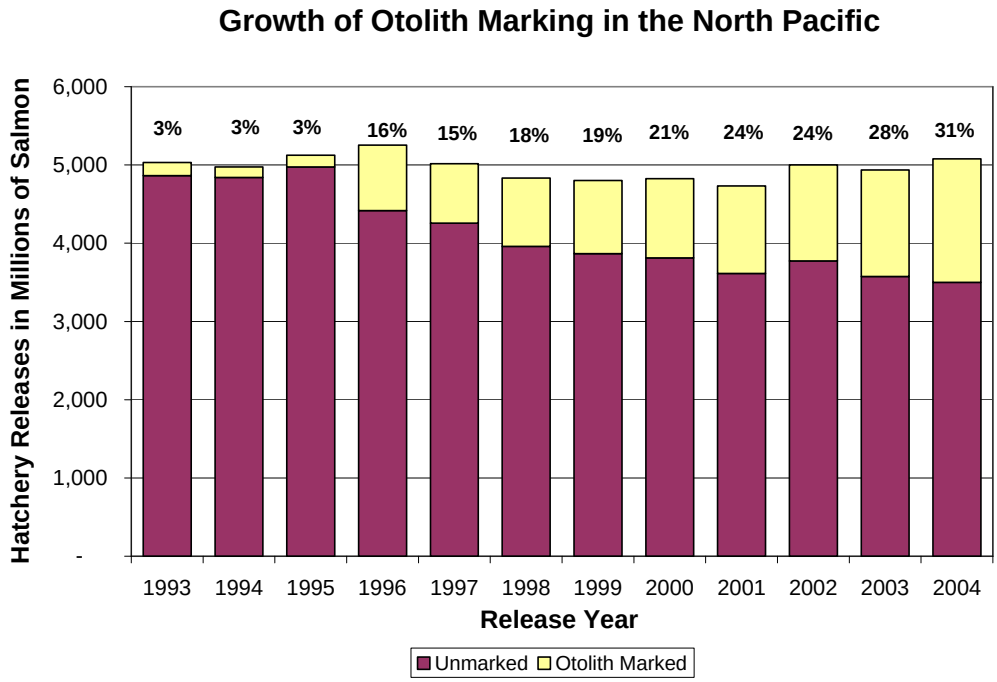


Figure 1. Number of NPAFC-member hatchery marked and unmarked salmon otoliths by year of release.

In 1999 the Working Group on Salmon Marking outlined features desired in a North Pacific salmon mark database. They also suggested components for a web site that could be used for querying the database. At the time, NPAFC did not have resources for building such an application, but design work continued (North Pacific Anadromous Fish Commission 2001).

Alaska Department of Fish and Game (ADF&G) funded the creation and operation of a prototype system for cataloging marks in 2002 (Agler and Hagen 2002). Information supported included both images of representative prepared specimens, as well as detailed data regarding the affected fish and their treatments. The database application was installed in a free-standing web site that included documentation on the methods and purposes of otolith marking. Since that time parties have regularly submitted their latest marking data to ADF&G, who add it to the database. Mark records are cumulative and currently cover about 1,900 mark events for release groups beginning with brood year 1988. About 40% of them currently have web-retrievable images.

The need for improvement

The original data updating process is described in Agler, *et al.* 2004. It is cumbersome because it relies on several parties to edit and communicate data. The system offers little automated protection against typographical errors, duplicate records, old versions overwriting newer data and other technical data management faults. It relies on

spreadsheet submissions that must be parsed and copied into the database. Because spreadsheets cannot enforce constraints on data entry, it is possible to introduce errors.

Image transmittal is particularly complicated. It requires a person to make separate image files for each mark. Someone then uploads them to the central server using the rudimentary FTP process. Another person must be notified of their availability on the server. That person then has to determine which file names belong to which marks and manually specify each linkage to the database records.

These data update processes, while open to error, have a bigger fault: they separate the control of information and the responsibility for its accuracy from the originating party. There may be several persons who need to perform steps in the update process. And these persons typically span multiple parties, only one of whom may "own" the data.

There are few standards observed for coding and representing data. This may not appear a problem at first, but there are likely benefits to be gained by joining these mark data to recovery, catch, and hatchery culture data. To accomplish that, the mark data must share some commonly defined attributes with the other data. Much Pacific salmon data has been standardized for U.S. states and Canada (Lapi, *et al.*, 1990). In order to support joint stock management under the Pacific Salmon Treaty, the Pacific Salmon Commission (PSC) actively maintains a comprehensive database with standard combined U.S. and Canadian data going back to 1967 (TCDS, 2001). It could be valuable for the otolith mark database to have standard database keys that allow it to be joined to the PSC dataset for reporting purposes.

In order to query the database for specific patterns, a hatch code must be specified. New marking techniques employing strontium, calcein, and alizarin complexone have the potential to expand the number of unique marks available (Munk 1999). But these are not supported in the traditional hatch code.

The existing web site is built with vintage 2001 technology. Technical support for both the software and hardware platform is being discontinued. Because this was built as a demonstration prototype, the web site is not registered by ADF&G as a production facility. It is not provided with comprehensive levels of intrusion detection, performance tuning, automatic software patching and backup/recovery.

Perhaps most urgently, the State of Alaska, whose network facilities are employed by the current system, is undergoing a major security overhaul. Because the existing system was not engineered to meet current required security standards, state network management scheduled shutting off connectivity to the original website in early 2007.

In order to overcome those issues in the otolith mark facility identified above, ADF&G commissioned its professional Information Technology (IT) group to recreate the system following industry best practices.

Features of the new facility

Each country has sole authority and responsibility for entering data of their own otolith marked releases.

Data entry is done by filling out a web form for each mark event. A web browser located anywhere in the world may be used for data entry. Each jurisdiction's mark coordinator needs a user id and password in order to update their data. Each coordinator is restricted to changing only data within their jurisdiction. It is not possible for, say, the record of a Japanese mark to be edited by someone from Washington. Updates to the database become effective immediately after pressing the SAVE button on the web page.

The web entry form supports one photograph of the mark from a prepared specimen. The mark coordinator, while entering details, may browse to a particular image file and have the contents of the file stored in the database. Images may be of type JPEG, GIF or PNG. Each image must not be larger than 1 megabyte. They display best when created with 640 by 480 pixel resolution.

While the database uses some specialized codes internally, user interaction is through descriptive words. Data entry will be primarily by dropdown boxes containing valid values. Report columns will generally show descriptive words instead of codes.

A basic level of consistency is guaranteed through enforcement of business rules during data update. The exact rule set is documented in Appendix I. Some rules are applied to all data entry. Other additional restrictions are enforced only on U.S. and Canada data entry. Some data from the U.S. and Canada have attributes well defined in the PSC standard data format version 4.1. Such data columns are internally coded to match the PSC standard form. Any additional constraints on these columns that are enforced by the PSC standard are also enforced on the mark database records.

The otolith mark database and web site now reside on a set of highly reliable production servers. They have been collocated with some critical harvest management systems, which receive a high level of technical care. The old MS Access database has been abandoned in favor of a high capacity Oracle 10.2 database management system (DBMS) located on a server having redundant hardware, power and UPS. The new database objects have significant data constraints, particularly tight enforcement of referential integrity. The Oracle DBMS has been highly tuned to give excellent performance. It is backed up three times daily, and backup media are rotated through offsite storage regularly. Annual archive snapshots are retained permanently.

State of Alaska requirements for computer security have been met. The web server and database have been "hardened" following manufacturer recommendations.

The new database has been populated with records from the old system as it stood on October 16, 2006. Some obvious editing of values was performed in the conversion process to meet basic database constraints, standardize spellings, overcome case mismatches, etc. The few records for non-anadromous fish, such as Kokanee, were not transferred into the new system.

Querying has been extended to allow users to specify many selection attributes. One report set allows anyone to call up summary lists of marks meeting specified criteria. The list consists of hypertext links that permit "drilling" into the complete data record for each mark, including photos. Another set allows reporting marks meeting criteria and detailing their characteristics in grid form. The grid may be printed. It may be copied and pasted into other Windows objects. It may also be opened in a Microsoft Excel spreadsheet.

The need to unambiguously encode a pattern as a hatch code may be met by following the method in the proposed Uniform Hatch Code detailed below. This also supports strontium and other new marking technologies. It is not essential for parties to adopt this coding scheme for their internal work. However, in order to make their data accessible to all other parties, it should be the coding everyone uses for submission into the central database. (For those employing the Washington/U.S. bar code nomenclature, Appendix III addresses generating Uniform Hatch Codes from bar codes.)

Query searches support "wild cards." These may be used to find matches to a partial pattern, one in which some rings are clear but others are obscure.

As an aid to applying the Uniform Hatch Code scheme, a tool, dubbed the "piano," is available during data entry. This screen object allows one to visually draw mark patterns using mouse clicks. The tool then calculates and applies Uniform Hatch Codes for the database from the drawn image. The piano is also available to specify patterns to retrieve on queries, including wild card searches. Its operation is explained in Appendix II.

The table and key structure for the underlying database is illustrated in Figure 2. Most NPAFC work uses a subset of these tables. The additional tables are used to ensure US and Canada attributes conform to PSC data standards.

Example screens of the system are listed in Appendix III.

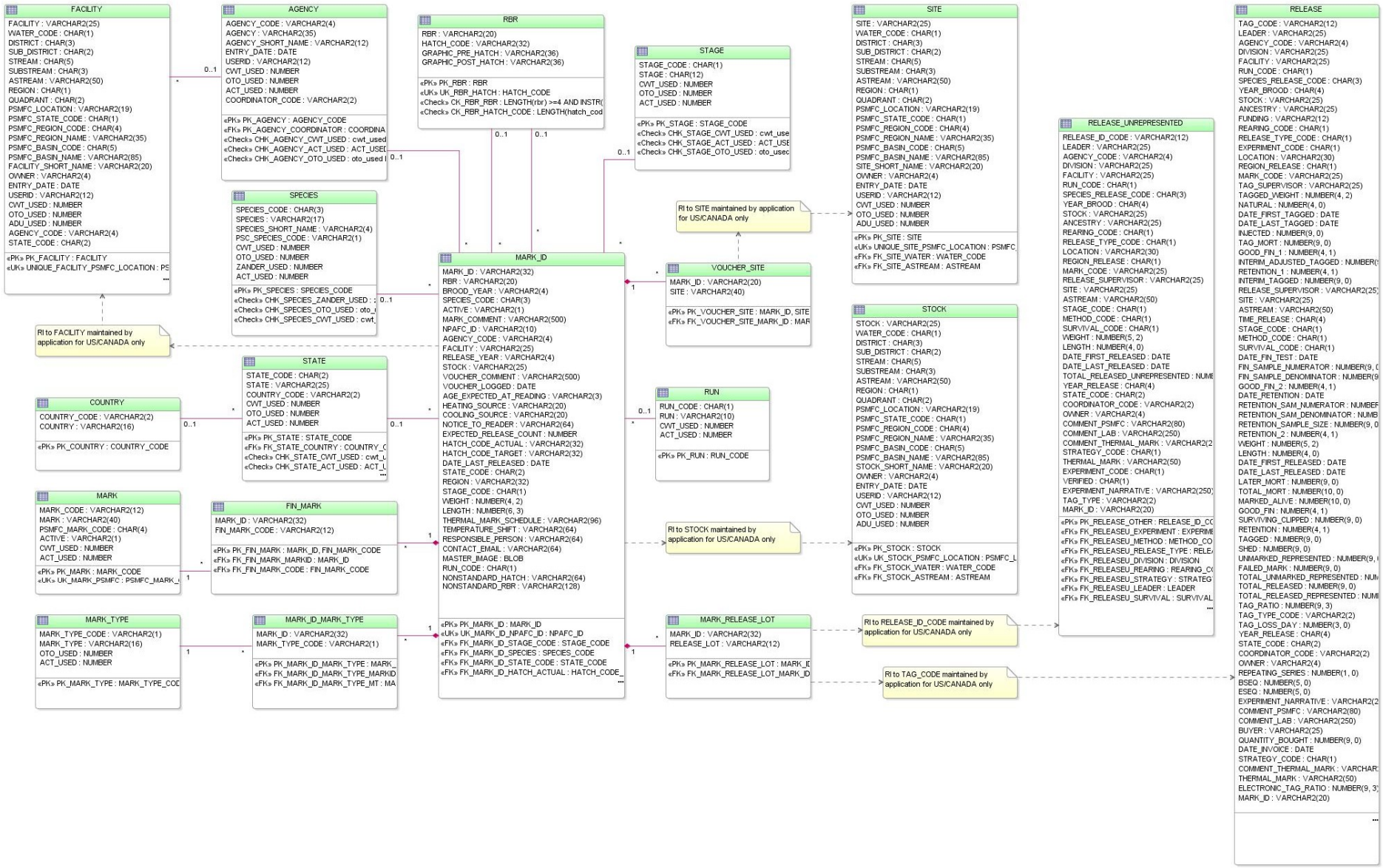


Figure 2: Database table and key structure.

Proposal for a "Uniform Hatch Code"

The Basis Of Encoding

Several pattern encoding schemes have been used during the evolution of otolith mark analysis. These include "Morse Code" by Brothers (1990), "Bar Code" by Volk et al. (1994), "RBr Code" by Munk and Geiger (1998), and "Hatch Code" by Hagen *et al*. (2000). Over time these schemes have usually met local needs adequately. However, these schemes do not produce values that are directly translatable among each other in all cases. For example transforming a Bar Code into a single RBr is neither easy nor obvious.

Specific Needs For Uniform Encoding

To query a database for specific marks, it is necessary to denote those marks by using a single deterministic encoding process. That way, a particular pattern code may be requested and all matching records are retrieved for that pattern. If, on the other hand, the same pattern was encoded on different records by different methods by different people, then a particular query could not unambiguously find all matches. For example, if one requested all marks for "3H" then every record encoded with "1:1.3" would be missed, even though associated specimens all have the same physical pattern. A single standard encoding scheme is needed, particularly when multiple jurisdictions using different schemes have all their data stored in a single database.

Furthermore, while thermal marks are adequately represented with the existing nomenclature, additional marking methods are now employed and must be considered. These alternative marking methods, including strontium and calcein, can be used in conjunction with other mark technologies. For example, a strontium mark can be used beside a thermal mark on the same otolith. Consequently, an encoding scheme is required that can accurately denote multiple mark types, and in spatially correct order.

Proposed Uniform Hatch Code

The proposed Uniform Hatch Code is an extension of the original Hatch Code from Hagen (2000). It makes specific provision to represent thermal marks as well as dry, strontium, alizarin complexone, and calcein marks. The scheme is readily adaptable to additional mark types that may be developed in the future. For those who prefer working with RBr nomenclature, the extensions may be translated into that format as well.

Complete Method for Assigning a Uniform Hatch Code

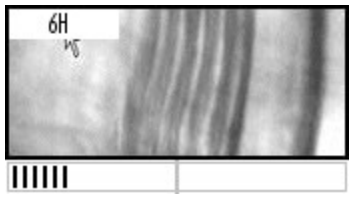
Thermal marks are characterized by bands consisting of one or more dark rings. There may be one or more bands of rings on an otolith. Encoding specifies the numbers of rings contained within each band and the spacing among the rings and bands. Thermal

rings, for purposes of this encoding scheme, are always dark. The rings are visually separated from each other by lighter interstitial material.

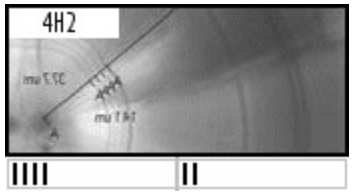
The Uniform Hatch Code is a string of characters. It has no size limit, though in use it will typically be only a few characters long. The actual characters allowed are {H0123456789,-/nwACS}. Uniform Hatch Code uses a capital "H" to indicate the hatch event.

A. Assign codes to represent the number of bands and rings

The number of rings in each band is listed before or after hatch, depending on the mark. The order of reading starts at the primordia and terminates at the outer edge of the otolith. For example, a 6H mark indicates that there is one band of 6 rings before the hatch event.



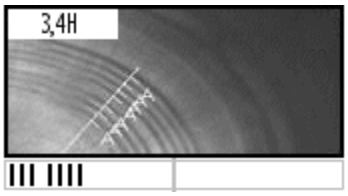
In another example, a 4H2 hatch code indicates that a band containing 4 rings was placed on the otolith prior to hatch, and a band containing 2 rings was added after hatch.



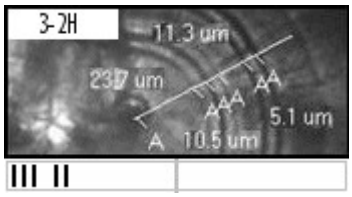
B. Assign codes to represent the spacing between bands

Some additional characters are used to more precisely characterize a mark. One group indicates relative spacing of bands. A different set of characters is used to indicate relative spacing of rings within each particular band (see part C, below).

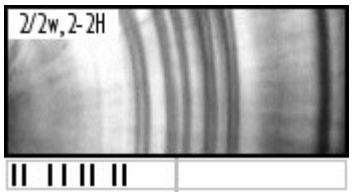
Spacing among bands is identified by either a comma (,), a dash (-) or a slash (/). *A comma represents a space among bands that is 2 to 2.5 times greater than the preceding ring interval,* as in the example 3,4H.



A dash represents a space that is 3 to 3.5 times greater than the preceding ring interval. 3-2H is an example.



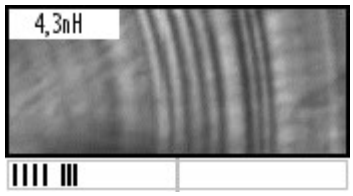
A slash represents a space that is 4 to 4.5 times greater than the preceding ring interval. Because these intervals may be



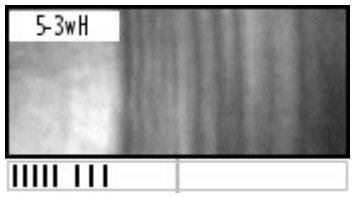
difficult to identify quickly, they are infrequently used. 2/2w,2-2H is an example

C. Assign codes to represent the relative spacing of rings within a band

Any spacing among rings within a band is relative and must be viewed in relation to another set of rings. Ring spacing within a band is presumed to be "normal" unless specifically designated as narrow or wide in the coding. *The lower case letter "n" is used in the Uniform Hatch Code to represent a narrow spacing of rings in a band. Narrow spacing should generally be designated only if normal spacing is also present*, because narrow spacing is only obvious when observed in conjunction with another ring's spacing. Narrow spacing should approximate one half the normal ring spacing. 4,3nH is illustrated.



The lower case letter "w" is used in the Uniform Hatch Code to represent a widely-spaced band of rings. Wide spacing should generally be designated if normal spacing is also present in the same mark and occurs on the same side of the hatch event, because wide spacing is only apparent when observed in conjunction with another ring's spacing. It is noted there may be some difficulty in distinguishing between wide, normal, and narrow spacing as they are not precisely defined quantitatively. "w" is illustrated by 5-3wH.



D. Assign codes to represent the mark types

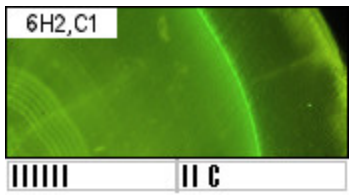
By default all rings are presumed to be the result of Thermal Marking / Dry Marking. It is not possible to physically distinguish patterns resulting from these two techniques, so the patterns cannot be given different encoding. If it is necessary for a particular purpose to determine which mark type was laid down, the original marking records must be consulted.

In the default thermal/dry mark situation, no additional coding is used to represent mark type. So the Uniform Hatch Code matches the coding used with earlier hatch code specifications. No translation or changes are required for these historical records.

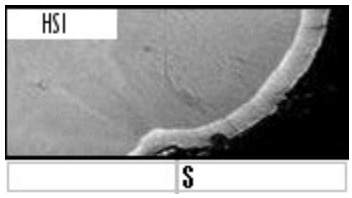
For other marking methods, a set of characters is defined for specifying the mark type and where that mark occurs relative to any other marks on a particular treatment group. These characters currently include A, C, and S. Additional designators may be easily defined to accommodate future new marking technologies.

The upper case letter "A" is used in the Uniform Hatch Code to indicate a ring of alizarin complexone. It prefixes the appropriate band/ring code. So a pre-hatch ALC single mark would be coded as A1H. A double ring band would be A2H. A single wide ring would code as A1wH. A triple narrow ring becomes A3nH. A single ALC mark pre-hatch, followed by two bands of three thermal marks after hatch would be A1H3,3.

The upper case letter "C" is used in the Uniform Hatch Code to indicate a ring of calcein. It prefixes the appropriate band/ring code. The code 6H2,C1 represents a mark composed of a band of six thermal rings, the hatch event, a two ring thermal band and a single calcein band.



The upper case letter "S" is used in the Uniform Hatch Code to indicate a ring of strontium. It prefixes the appropriate band/ring code. For example, one post-hatch treatment of strontium chloride results in a mark of HS1.



(Note: The authors are aware that a paper proposing simplification of the mark codes has been submitted to the Working Group on Salmon Marking (Josephson, *et al.,* 2006). Because these changes have not yet been fully discussed and formally accepted, we have not included any of those proposals in the design of the Uniform Hatch Code. If the Working Group desires to simplify the coding, this computer system will readily accommodate those changes.)

Final implementation actions required

The new facility is operational as of October 23, 2006. In order for the Working Group to realize the system's full capabilities, several actions must be completed.

1. Each mark coordinator must be identified and provided with a user id and password. While the public may query the database, data may be entered only by those given explicit responsibility and authorization.

2. Universal agreement on a Uniform Hatch Code encoding scheme should be completed. Until a precise and unambiguous process is adopted, it will not be possible to reliably query for specific patterns.

3. The new database was built with records from the old system. Certain records had their hatch code adjusted slightly to fit the proposed Uniform Hatch Code scheme. However, in cases where it was not obvious there was one best hatch code to use, the original value was retained as a "tentative" code. The mark coordinators need to determine the best Uniform Hatch Code and update their records. A single Uniform Hatch Code is required to be able to retrieve records by pattern – a tentative code cannot be used for data searches. An audit report is available to mark coordinators that details which of their hatch codes are tentative.

4. The system requires future data entry by US and Canada users to employ PSC standardized names and codes for certain commonly used fields. However, the historic data have not been forced to meet this requirement. In the interest of future usability, it could be valuable for US and Canada mark coordinators to review existing records and standardize names for hatchery, release sites, and stock.

5. The need for a user training program must be assessed.

6. The new applications for entry and querying must be put on a formal IT life-cycle maintenance program to ensure they stay current and accurate.

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Appendix I - Detailed business rules for data entry

Data in this system are guaranteed to provide a basic level of meaning and consistency. This is accomplished by enforcing a set of "business rules" during data entry and update. Rules are enforced in both the entry application and in the database definitions. Some rules are conditional. That is, they are only applied in particular circumstances or to certain jurisdictions. The rules are enumerated below:

AGENCY

Must match a valid agency predefined in the NPAFC Mark Directory.

BROOD_YEAR

Must be a valid Year between 1988 and current Year.
May not be greater than RELEASE_YEAR.
Last two digits must match 3rd and 4th digit of NPAFC_ID.

CONTACT_EMAIL

Must have the form of a valid email address.
May not exceed 64 characters.

COUNTRY_CODE

Required value.
Must match a valid code predefined in the NPAFC Mark Directory.

DATE_LAST_RELEASED

Must be a valid date between 1/1/1988 and current date.
Year must match RELEASE_YEAR.

EXPECTED_RELEASE_COUNT

Must be only digits with no punctuation.
Zero is allowed.

FACILITY

Only one value is allowed.
May not exceed 25 characters.
[US and Canada Only] Must be a valid facility as defined in the Pacific Salmon Commission Coded Wire Tag (CWT) Database (specification version 4.1).
[Non-US and Canada] Existing facilities are suggested, but any value may be specified.

FIN_MARK_CODE

Must be a valid fin mark predefined in the NPAFC Mark Directory.

HATCH_CODE

Must contain only characters from the set {H0123456789,-/nwACS}.

Must be a valid Uniform Hatch Code predefined in the NPAFC Mark Directory.

In the event a new hatch code is used in the database for the first time it will be provisionally recorded, but not made permanent until an administrator validates the form of the new hatch code. *A mark record may not be retrieved by query until its hatch code is permanent.*

LENGTH

If entered, must be greater than zero and less than 160 mm.

MARK_COMMENT

May not exceed 500 characters.

MARK_TYPE_CODE

Must be a valid mark type predefined in the NPAFC Mark Directory.

MASTER_IMAGE

Must be a JPG, GIF or PNG formatted image.

May not exceed 1 MB in size.

NPAFC_ID

Required value.

Must match the following pattern:

[US Only] First two characters must match State Code.

[Non-US] First two characters must match Country Code.

3rd and 4th characters must match last two digits of Brood Year.

5th character should be a hyphen.

Last two digits are a unique identifier assigned by NPAFC Mark Directory at data entry time.

RBR

In the event the HATCH_CODE is provisional and not permanent, then an RBR value of the mark may be temporarily recorded. *Once a hatch code is verified and made permanent, the RBR will always be calculated by a symbolic transform on the hatch code. The temporary RBR recorded at data entry time will be erased once the record's hatch code is permanen*t.

REGION

May not exceed 32 characters.

RELEASE_LOT

Multiple values may be specified.

[US and Canada Only] Must match a valid Tag Code or Release ID Code in the Pacific Salmon Commission CWT Database (specification version 4.1).

[Non-US and Canada] Each entry may not exceed 12 characters.

RELEASE_YEAR
Must be a valid year between 1988 and current year.
Must be greater than or equal to BROOD_YEAR.
Must match year part of DATE_LAST_RELEASED.

RESPONSIBLE_PERSON
May not exceed 64 characters.

RUN
Must be a valid run predefined in the NPAFC Mark Directory.

SITE
Multiple values may be specified.
Each value may not exceed 40 characters.
[US and Canada Only] Must match a valid Release Site in the Pacific Salmon Commission CWT Database (specification version 4.1).
[Non-US and Canada] Existing sites are suggested, but any values may be specified.

SPECIES
Must be a valid species predefined in the NPAFC Mark Directory.

STAGE_CODE
Must be a valid stage predefined in the NPAFC Mark Directory.

STATE_CODE
Required value.
Must be a valid code predefined in the NPAFC Mark Directory.

STOCK
Only one value is allowed.
May not exceed 25 characters.
[US and Canada Only] Must be a valid stock as defined in the Pacific Salmon Commission CWT Database (specification version 4.1).
[Non-US and Canada] Existing stocks are suggested, but any value may be specified.

TEMPERATURE_SHIFT
May not exceed 64 characters.

THERMAL_MARK_SCHEDULE
May not exceed 128 characters.

WEIGHT

If entered, must be greater than 0 and less than 100 grams.

Appendix II – Using the piano object

To simplify entry of mark patterns, the system provides a coding tool nicknamed the "piano." It may be used to sketch ring patterns on a screen. The technique involves pointing to "keys" with a mouse and clicking on them. The pattern of colored and white keys depicts the dark and light otolith rings. Most users find the piano's use immediately intuitive. As the pattern is defined, the computer calculates the appropriate Uniform Hatch Code to use for the database by parsing the piano keys.

The following actual screen image represents "4n,2HS2":

Basic instructions

1) Select one of the five possible mark types by clicking on its "radio button."
2) Click on an empty "key" to place the ring mark in that location.
3) To remove a particular ring mark, click on its key again.
4) Be sure to include one hatch mark. (We're sure the fish has one of these!) All other marks are optional.
5) The piano insists on having at least one space between each ring. It will never paint a ring directly alongside another ring.

Conventions for use

A few conventions must be observed when using this tool. The first group deals with defining rings within a band.

1) A ring mark may only be one space wide. That is, there must be one or more white spaces between each ring mark.
2) A one space gap is considered narrow: 'n' in the hatch code scheme.
3) A two space gap is considered normal: which has no special designator in the hatch code.
4) A three space gap is considered wide: 'w' in the hatch code.

The second set of conventions is used to distinguish distance among bands.

1) There must be at least four white spaces separating each band. However, drawing in the "H" for hatch mark implicitly separates bands.

2) There must be one and only one hatch mark entered.
3) Four white spaces denote a relatively narrow band separation: comma (,) in the hatch code.
4) Five white spaces indicate a medium separation between bands: dash (-) in the hatch code.
5) Six white spaces indicate a wide separation between bands: virgule (/) in the hatch code.
6) Within a band, ring spacing must be uniform. For example, in a particular band each ring may be separated by two white spaces; it is not possible for some to be separated by two spaces and others to be separated by one space. If spacing is not uniform in the physical otolith, then the rings need to be laid out in different bands by including at least four spaces between them.

Chemical rings such as calcein, alizarin, and strontium are used in the same way as thermal marks – except each ring mark is painted on the screen in a particular color identifying the chemical used. Within a band, only one mark type may be used. Rings in a particular band must be all thermal, or all calcein, etc.

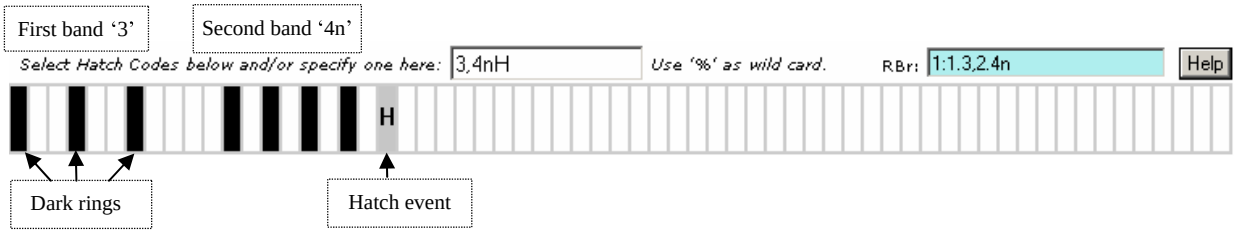
The use of multiple mark types is illustrated below.

Different operation between data entry and query

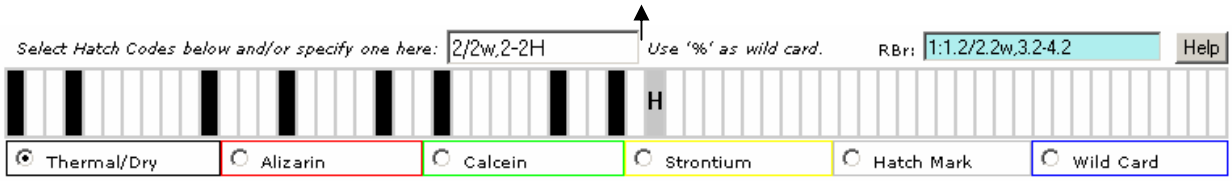
During data entry one may click in thermal marks, chemical marks, and a single hatch mark. The final pattern that results is stored with that release record and is the basis for its Uniform Hatch Code and RBR values.

When one retrieves data in a query this same functionality is also present. However, one additional mark is available to put on piano keys. This is referred to as the "wild card." A wild card is a mark that matches any arbitrary pattern. On the screen a wild card is displayed in the hatch code as a percent sign (%). As an example, querying for a pattern that matches hatch code "3%H" will retrieve releases coded with "3,3H", "3,2nH", "3H", etc. A query may have multiple wild cards specified for it, such as "2%3%H1S%." The purpose of wild card searching is to find possible matches for a specimen having some obvious rings but also some marks that are difficult to see.

Examples



Thermal/dry marks on both sides of hatch mark.



Spacing between bands: very wide (/), normal (,), and wide (-).

One calcein band between two thermal/dry bands.

One band of alizarin complexone, post-hatch.

A band of strontium post-hatch, then a band of calcein (with 2 rings), then a thermal mark.

Appendix III – Mapping Bar Code Nomenclature to Uniform Hatch Code

Bar Code nomenclature is used internally by Washington Department of Fisheries in the United States. It differs fundamentally from other schemes by denoting the light space in patterns rather than the dark rings. Its symbols are mapped as follows:

Symbol	Meaning	Uniform Hatch Code Mapping
<space>	Separator between pre- and post-hatch	The space is treated as the hatch mark 'H'.
n	Narrow space between two dark rings	N consecutive occurrences of 'n' are treated as one band having N+1 rings of normal spacing within the band. For example, 'nnn' maps into 4.
w	Wide spacing between rings	Treated as a standard band separator ','. There is implicitly a dark ring to the left and the right of 'w'.
x	Extra wide spacing between rings.	Treated as a wide band separator '-'. There is implicitly a dark ring to the left and right of 'x'.
0	No rings present on this side of hatch mark	Ignored. This has no effect on uniform hatch code.

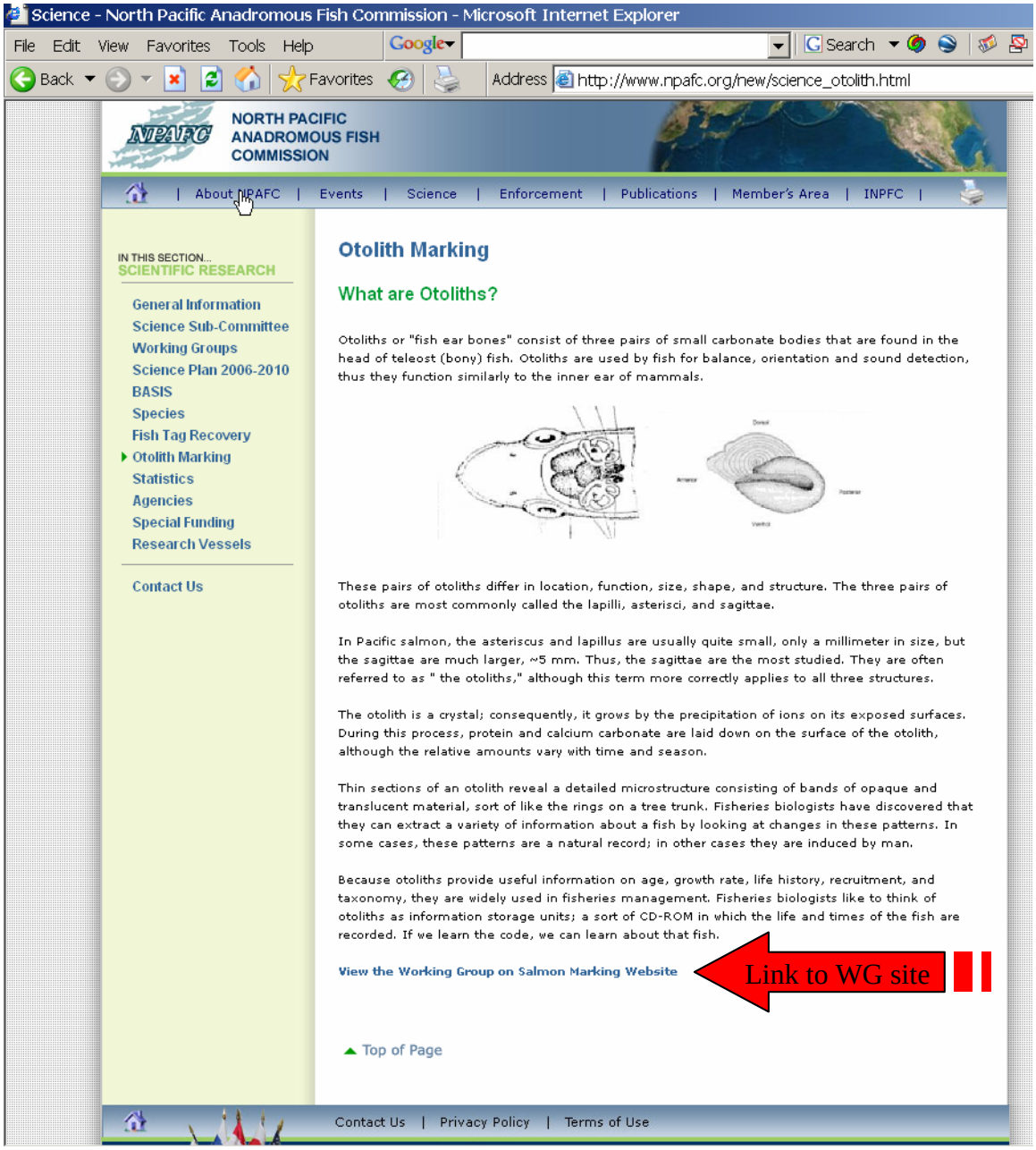
Examples:

Bar Code 'nn 0'

Bar Code '0 nwwnn'

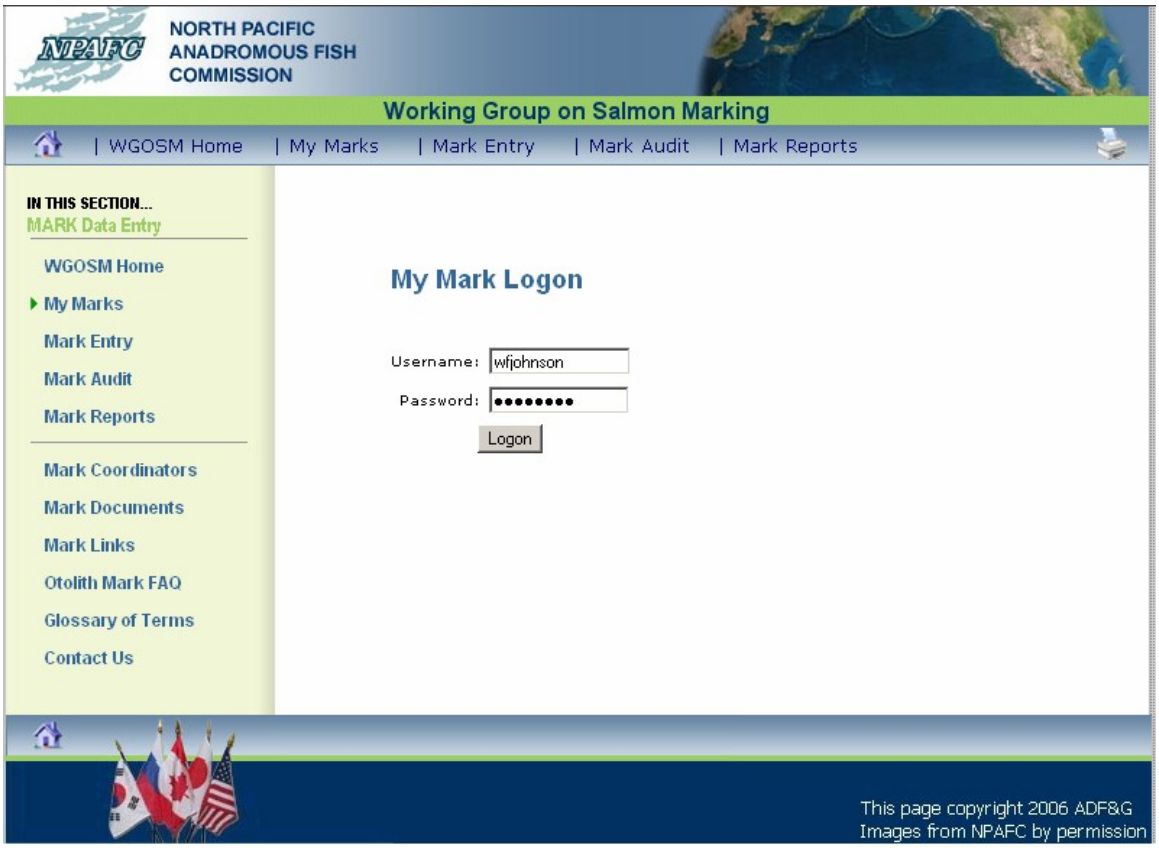
Bar Code 'nnn nxw'

Appendix IV – Screen examples



http://www.npafc.org/new/science_otolith.html contains the entrance to the Working Group's extended web facility

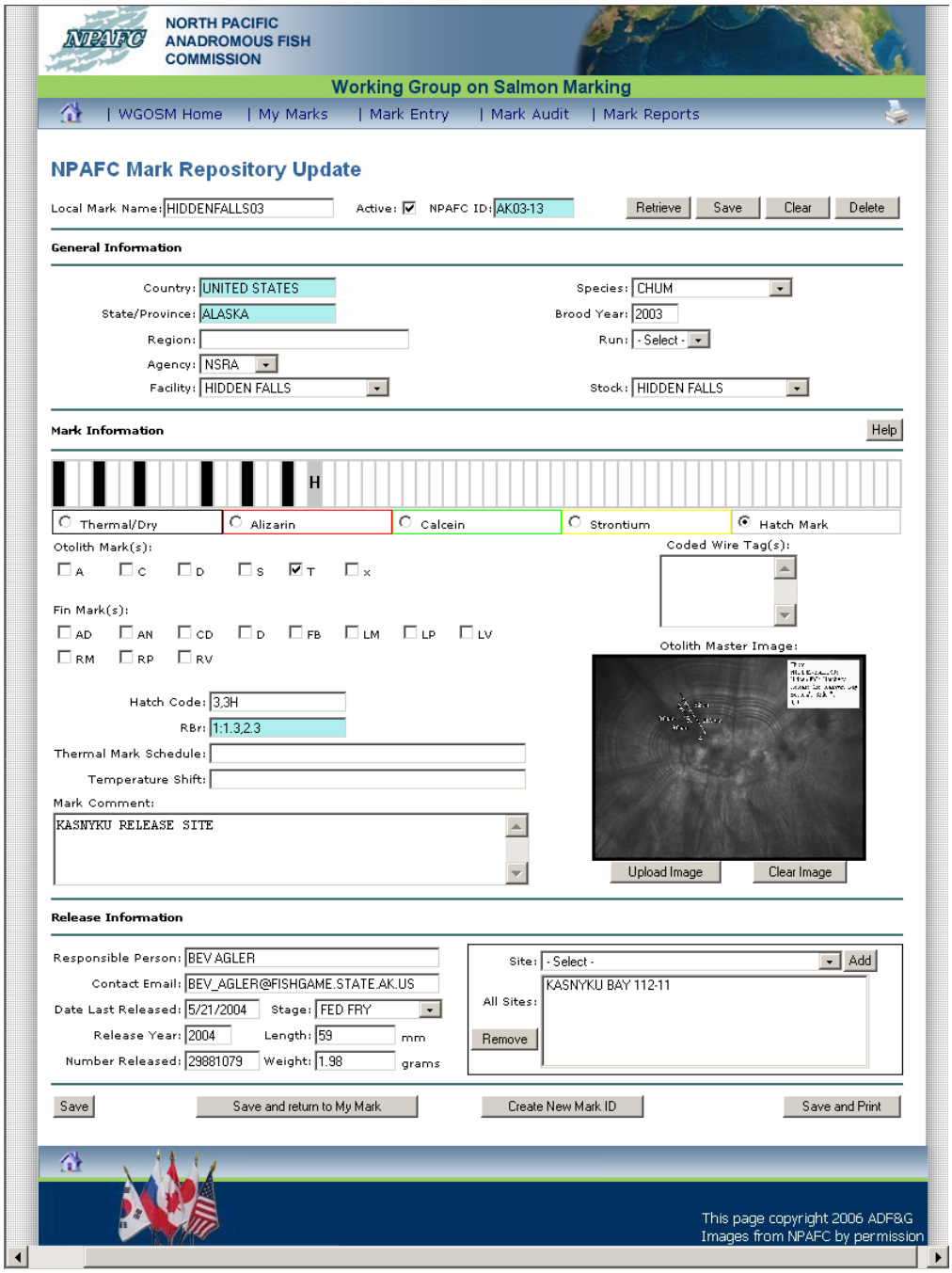
http://npafc.taglab.org/default.asp home page of the Working Group on Salmon Marking



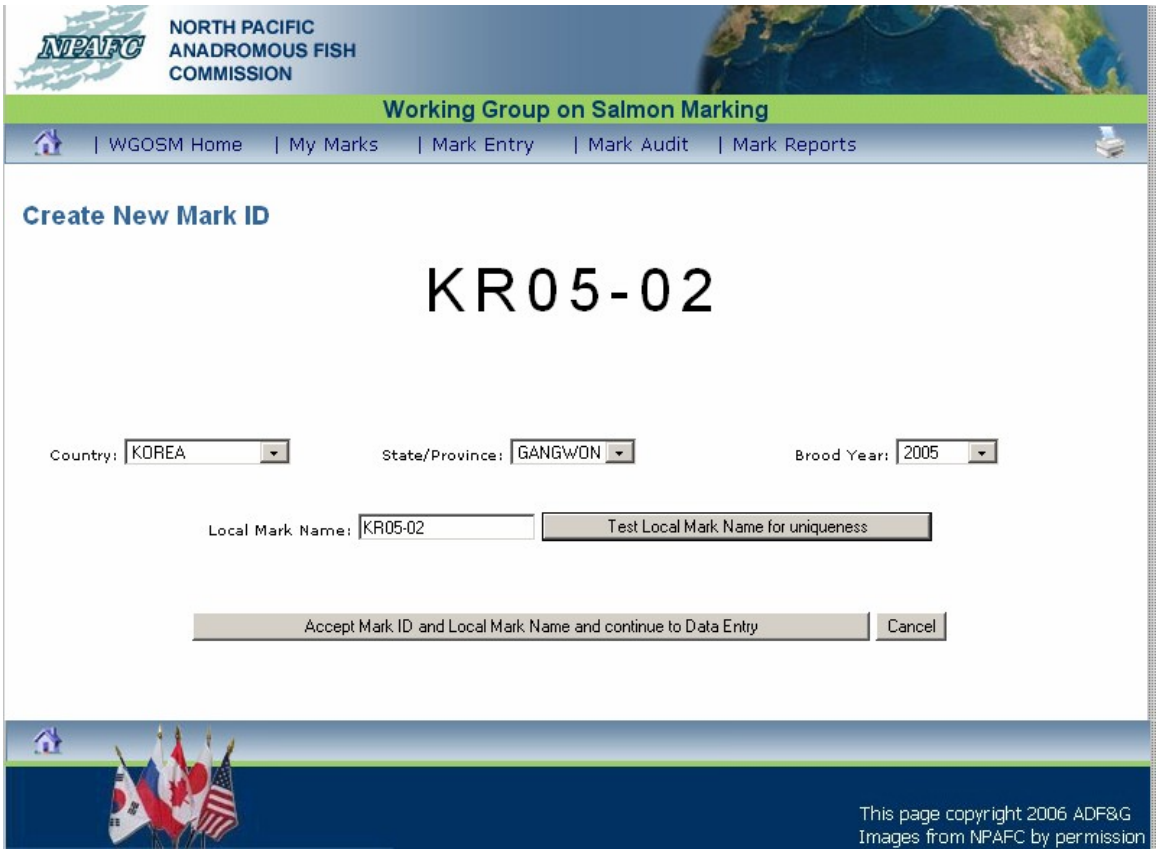
Each jurisdiction has a coordinator authorized to enter and update all mark information from their area. The public is permitted to view all reports on the site. Data update, however, is limited to Mark Coordinators and requires authorized credentials.

Local Mark Name	NPAFC ID	Country	Species	Brood Year	Facility
		UNITED STAT	CHUM	2003	- Select -
AMALGA03A	AK03-24	UNITED STATES	CHUM	2003	MACAULAY
AMALGA03B	AK03-25	UNITED STATES	CHUM	2003	MACAULAY
ANITABAY03	AK03-30	UNITED STATES	CHUM	2003	NEETS BAY
BOATHARBOR03	AK03-28	UNITED STATES	CHUM	2003	MACAULAY
DEEPINLETHF03	AK03-17	UNITED STATES	CHUM	2003	MEDVEJIE
DEEPINLETHF03LLG	AK03-18	UNITED STATES	CHUM	2003	MEDVEJIE
DEEPINLETM03LLG	AK03-19	UNITED STATES	CHUM	2003	MEDVEJIE
GASTINEAU03A	AK03-26	UNITED STATES	CHUM	2003	MACAULAY
GASTINEAU03B	AK03-27	UNITED STATES	CHUM	2003	MACAULAY
HIDDENFALLS03	AK03-13	UNITED STATES	CHUM	2003	HIDDEN FALLS
HIDDENFALLS03LLG	AK03-14	UNITED STATES	CHUM	2003	HIDDEN FALLS
KENDRICK03	AK03-31	UNITED STATES	CHUM	2003	NEETS BAY
LIMESTONE03	AK03-29	UNITED STATES	CHUM	2003	MACAULAY
NAKATINLET03FALL	AK03-21	UNITED STATES	CHUM	2003	NEETS BAY
NAKATINLET03SUM	AK03-20	UNITED STATES	CHUM	2003	NEETS BAY
NEETSBAY03FALL	AK03-23	UNITED STATES	CHUM	2003	NEETS BAY
NEETSBAY03SUM	AK03-22	UNITED STATES	CHUM	2003	NEETS BAY
PORTCHALMERS03	AK03-15	UNITED STATES	CHUM	2003	WALLY NOERENBERG
TAKATZ03	AK03-16	UNITED STATES	CHUM	2003	HIDDEN FALLS
WA03-11	WA03-11	UNITED STATES	CHUM	2003	Hurd Creek Hatchery
WA03-12	WA03-12	UNITED STATES	CHUM	2003	Hurd Creek Hatchery
WA03-13	WA03-13	UNITED STATES	CHUM	2003	Lilliwaup Hatchery
WA03-14	WA03-14	UNITED STATES	CHUM	2003	Lilliwaup Hatchery
WA03-15	WA03-15	UNITED STATES	CHUM	2003	Hurd Creek Hatchery
WA03-16	WA03-16	UNITED STATES	CHUM	2003	Hurd Creek Hatchery
WA03-17	WA03-17	UNITED STATES	CHUM	2003	Lilliwaup Hatchery
WA03-18	WA03-18	UNITED STATES	CHUM	2003	Hurd Creek Hatchery
WA03-19	WA03-19	UNITED STATES	CHUM	2003	Big Beef Creek Facility

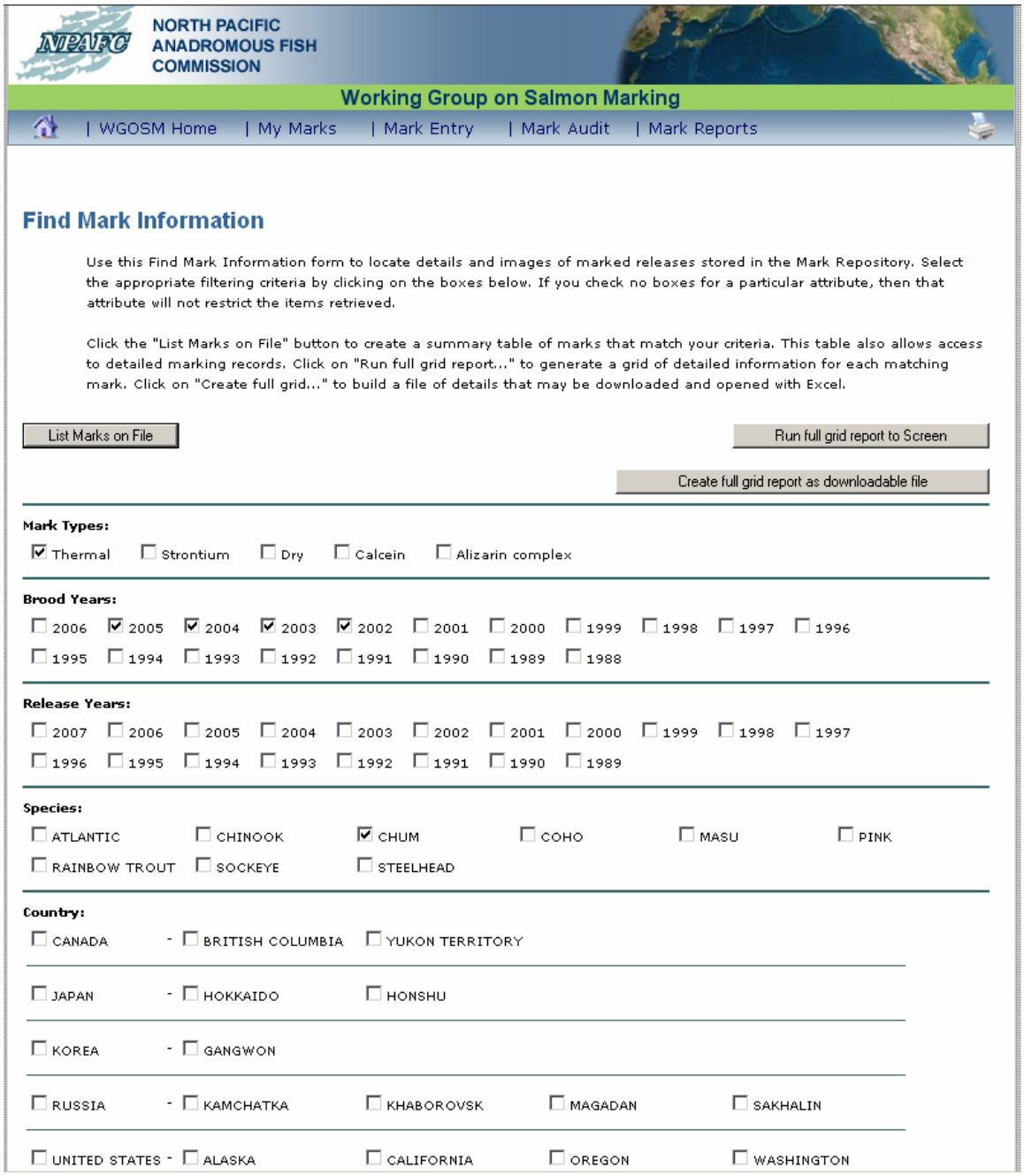
The My Marks page lists all the marking records that are in the user's jurisdiction. The left column contains blue hyperlinks. By clicking a hyperlink, that page is brought up for editing. The Mark Coordinator may update everything in their pages whenever they wish. The button at the top of the form may be pressed to define a new mark record for the first time. First time records get automatically assigned a unique NPAFC ID based on the country and brood year.



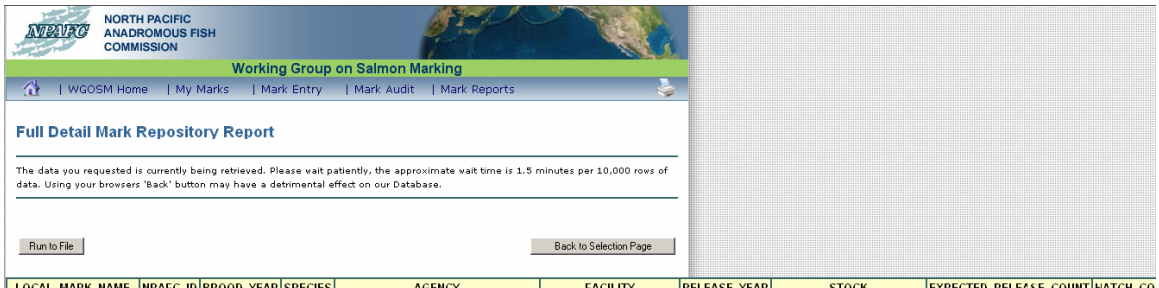
The Mark Coordinator uses this page to update data. Dropdown boxes are used on several entries to ensure consistent names are entered. An image of a representative otolith may be included for each mark record. The "Upload Image" button is used to insert a picture file from a user's machine into the database. The "piano" object may be used to enter the pattern, or a hatch code may be entered from the keyboard. The three blue fields are fixed and may not change.



http://npafc.taglab.org/NewMark.asp This screen is used to create a brand new record of a marked group. After selecting items from the three drop-down boxes, a unique NPAFC ID is automatically generated. A "local" mark name may also be specified that clearly identifies this group to its Mark Coordinator. If a local mark name is supplied, then it must be unique and cannot match the local mark name of other entries. If not specified, the system will generate a local mark name that is the same as the NPAFC ID.

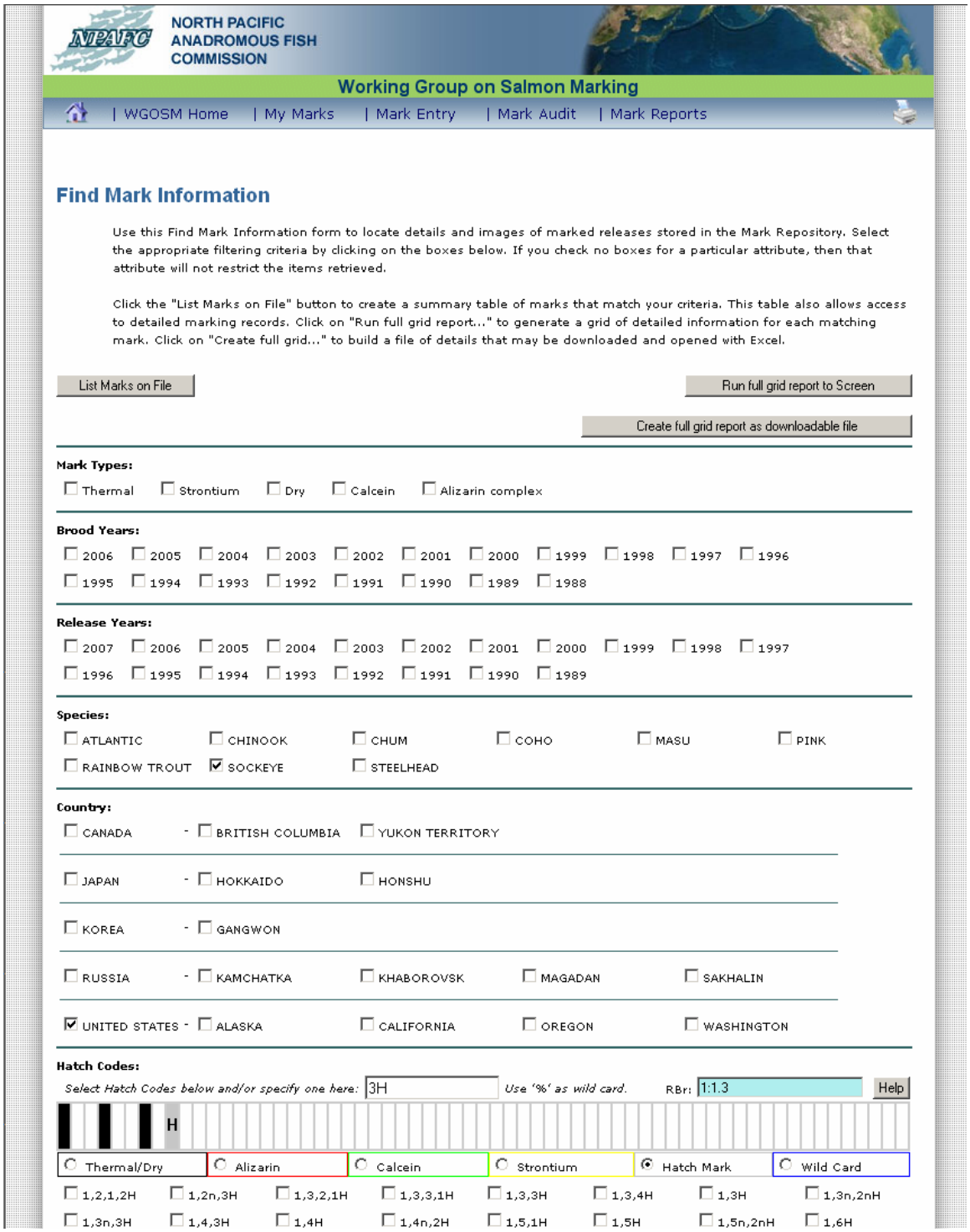


Mark records for reporting may be selected by clicking on mark attributes.



LOCAL_MARK_NAME	NPAFC_ID	BROOD_YEAR	SPECIES	AGENCY	FACILITY	RELEASE_YEAR	STOCK	EXPECTED_RELEASE_COUNT	HATCH_CO
17MILE05		2005	CHUM	NORTHERN SE REG AQUACULTURE (AK)	HERMAN CR SPAWN CHAN	2006			4H
AMALGA02A	AK02-13	2002	CHUM	DOUGLAS ISLAND PINK & CHUM (AK)	MACAULAY	2003	MACAULAY	17,500,604	6H
AMALGA02B	AK02-08	2002	CHUM	DOUGLAS ISLAND PINK & CHUM (AK)	MACAULAY	2003	MACAULAY	17,377,675	6H6
AMALGA03A	AK03-24	2003	CHUM	DOUGLAS ISLAND PINK & CHUM (AK)	MACAULAY	2004	MACAULAY	24,035,968	5H
AMALGA03B	AK03-25	2003	CHUM	DOUGLAS ISLAND PINK & CHUM (AK)	MACAULAY	2004	MACAULAY	12,006,165	5H6
AMALGA04A	AK04-23	2004	CHUM	DOUGLAS ISLAND PINK & CHUM (AK)	MACAULAY	2005	MACAULAY	31,672,288	4H
AMALGA04B	AK04-28	2004	CHUM	DOUGLAS ISLAND PINK & CHUM (AK)	MACAULAY	2005	MACAULAY	5,118,857	4H6
ANITABAY02NBH	AK02-66	2002	CHUM	SOUTHERN SE REG AQUACULTURE (AK)	NEETS BAY	2003	NEETS BAY	5,411,130	4H3
ANITABAY02WLH	AK02-18	2002	CHUM	SOUTHERN SE REG AQUACULTURE (AK)	WHITMAN LAKE	2003	NEETS BAY	8,219,503	3,4nH
ANITABAY03	AK03-30	2003	CHUM	SOUTHERN SE REG AQUACULTURE (AK)	NEETS BAY	2004	NEETS BAY	13,895,916	5nH4
ANITABAY04	AK04-09	2004	CHUM	SOUTHERN SE REG AQUACULTURE (AK)	NEETS BAY	2005	NEETS BAY	13,551,600	3,2n,2nH
ANITABAY05		2005	CHUM	SOUTHERN SE REG AQUACULTURE (AK)	NEETS BAY	2006	NEETS BAY		1,3,3,1H
BOATHARBOR02	AK02-09	2002	CHUM	DOUGLAS ISLAND PINK & CHUM (AK)	MACAULAY	2003	MACAULAY	12,223,213	6H4
BOATHARBOR03	AK03-28	2003	CHUM	DOUGLAS ISLAND PINK & CHUM (AK)	MACAULAY	2004	MACAULAY	14,576,139	5H4
BOATHARBOR04	AK04-26	2004	CHUM	DOUGLAS ISLAND PINK & CHUM (AK)	MACAULAY	2005	MACAULAY	13,558,987	4H4
CA02-31	CA02-31	2002	CHUM	CANADA DEPT FISHERIES & OCEANS	Nitinat River Hatchery	2003	Nitinat River	2,645,999	3,1H
CA02-32	CA02-32	2002	CHUM	CANADA DEPT FISHERIES & OCEANS	Nitinat River Hatchery	2003	Nitinat River	5,997,307	3,1H
CA02-33	CA02-33	2002	CHUM	CANADA DEPT FISHERIES & OCEANS	Nitinat River Hatchery	2003	Nitinat River	3,014,384	3,1H
CA02-34	CA02-34	2002	CHUM	CANADA DEPT FISHERIES & OCEANS	Nitinat River Hatchery	2003	Nitinat River	11,100,152	3,1H
CA02-35	CA02-35	2002	CHUM	CANADA DEPT FISHERIES & OCEANS	Nitinat River Hatchery	2003	Nitinat River	1,441,361	
CA02-36	CA02-36	2002	CHUM	CANADA DEPT FISHERIES & OCEANS	Nitinat River Hatchery	2003	Nitinat River	1,474,141	
CA02-37	CA02-37	2002	CHUM	CANADA DEPT FISHERIES & OCEANS	Conuma River Hatchery	2003	Canton Creek	892,140	H2,2
CA02-38	CA02-38	2002	CHUM	CANADA DEPT FISHERIES & OCEANS	Conuma River Hatchery	2003	Deserted River	341,635	H2,2
CA02-39	CA02-39	2002	CHUM	CANADA DEPT FISHERIES & OCEANS	Conuma River Hatchery	2003	Sucwoa River	445,007	

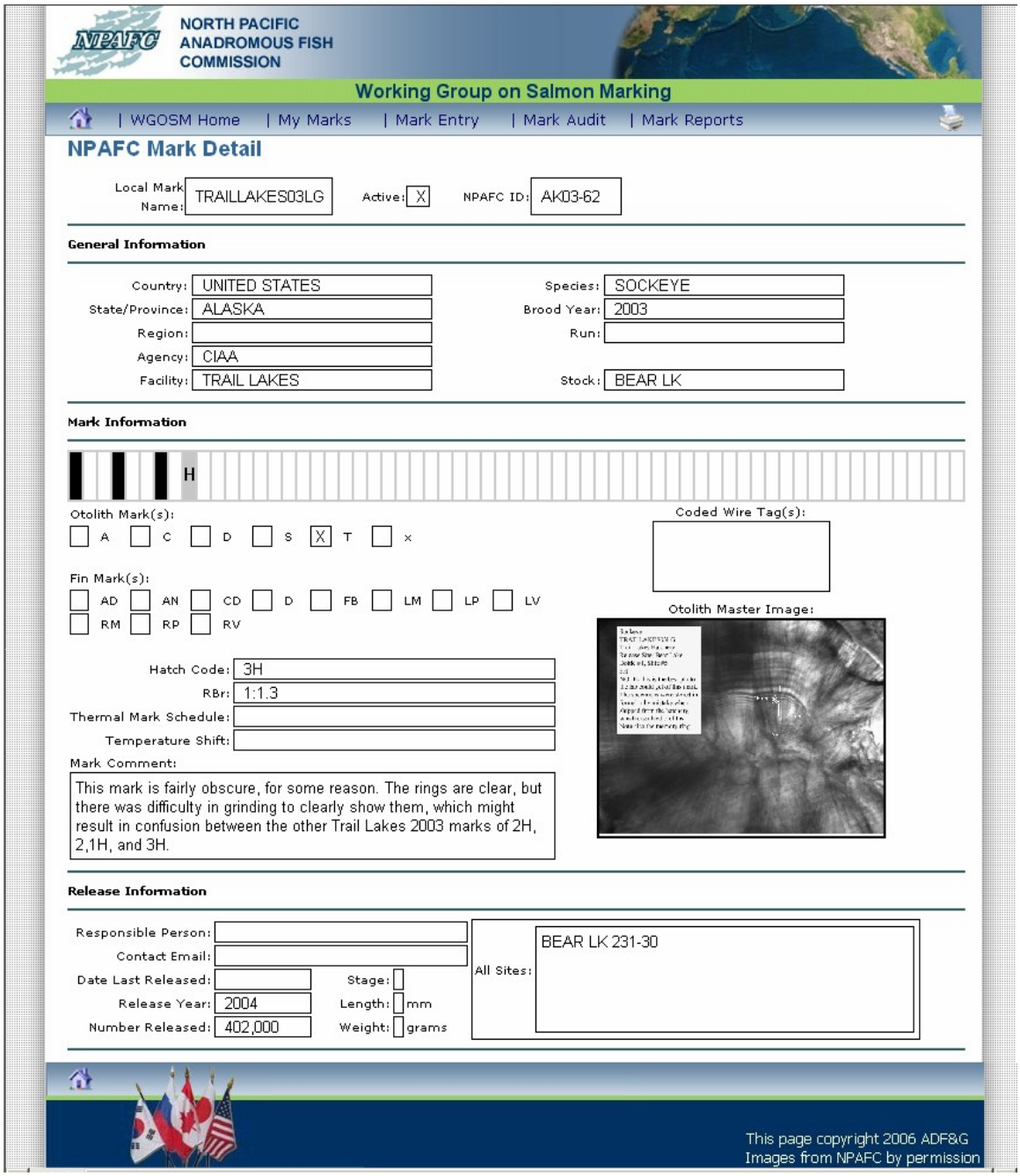
Query results may be displayed as a detailed grid of mark attributes. Web page grids may be copied and pasted into documents using standard Windows mechanisms. Grid reports may also be generated as files to be downloaded and opened by tools like Excel.



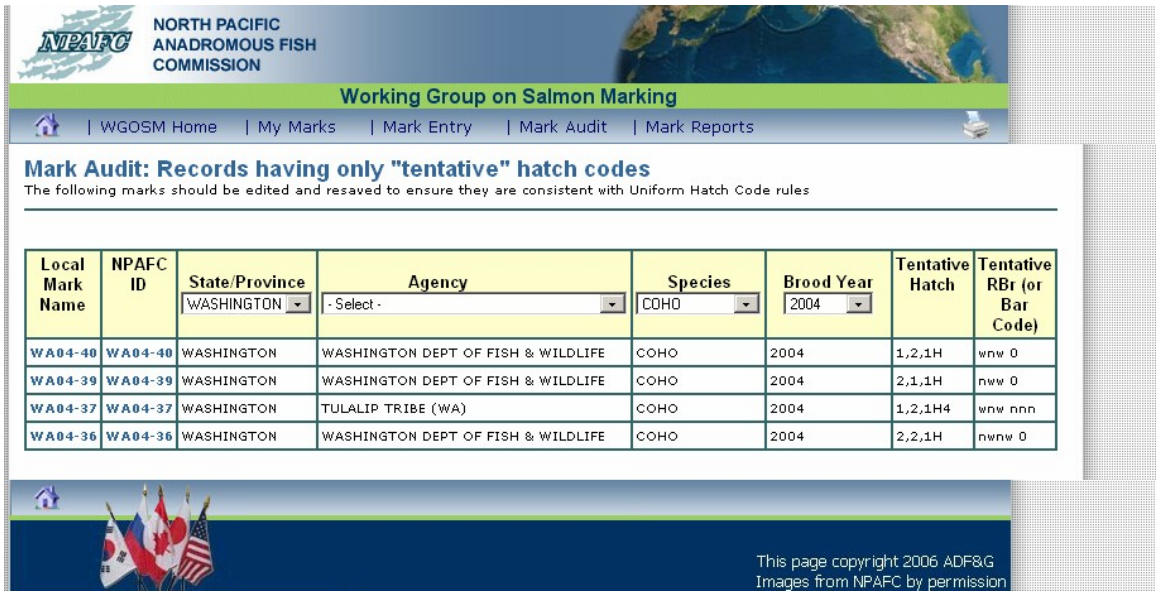
Queries may also use the "piano" to specify items to retrieve. In this example, the piano was used to call up all hatch code 3H items. The check boxes were also employed to restrict results to Sockeye from the USA.

NPAFC ID	Local Mark ID	Brood Year	Release Year	Species	Country	State / Province	Facility	Hatch Code
AK03-56	TUSTUMENA03	2003	2004	SOCKEYE	UNITED STATES	AK	TRAIL LAKES	3H
AK03-62	TRAILLAKES03LG	2003	2004	SOCKEYE	UNITED STATES	AK	TRAIL LAKES	3H
AK02-62	TUSTUMENA02	2002	2003	SOCKEYE	UNITED STATES	AK	TRAIL LAKES	3H
AK00-66	HANSEN00	2000	2000	SOCKEYE	UNITED STATES	AK	HANSEN CR INCUBATION	3H
AK96-33	GROUSELAKE96A	1996	1998	SOCKEYE	UNITED STATES	AK	TRAIL LAKES	3H
AK95-30	GROUSELAKE95B	1995	1997	SOCKEYE	UNITED STATES	AK	TRAIL LAKES	3H
AK96-23	PACKERSLAKE96	1996	1997	SOCKEYE	UNITED STATES	AK	TRAIL LAKES	3H
AK95-25	PACKERSLAKE95	1995	1996	SOCKEYE	UNITED STATES	AK	TRAIL LAKES	3H
AK93-19	GROUSELAKE93A	1993	1995	SOCKEYE	UNITED STATES	AK	TRAIL LAKES	3H
AK92-15	GROUSELAKE92	1992	1994	SOCKEYE	UNITED STATES	AK	TRAIL LAKES	3H
AK93-26	PACKERSLAKE93	1993	1994	SOCKEYE	UNITED STATES	AK	TRAIL LAKES	3H
AK92-18	PACKERSLAKE92	1992	1993	SOCKEYE	UNITED STATES	AK	TRAIL LAKES	3H
AK92-19	TRAILLAKES92	1992	1993	SOCKEYE	UNITED STATES	AK	TRAIL LAKES	3H
AK92-20	HIDDENLAKE92	1992	1993	SOCKEYE	UNITED STATES	AK	TRAIL LAKES	3H
AK91-13	PACKERSLAKE91	1991	1992	SOCKEYE	UNITED STATES	AK	TRAIL LAKES	3H
AK91-17	TRAILLAKES91	1991	1992	SOCKEYE	UNITED STATES	AK	TRAIL LAKES	3H
AK90-03	TATSAMENIE90	1990	1991	SOCKEYE	UNITED STATES	AK	SNETTISHAM	3H
AK90-12	TAHLTAN90	1990	1991	SOCKEYE	UNITED STATES	AK	SNETTISHAM	3H
AK88-02	SPEELLAKE88L	1988	1989	SOCKEYE	UNITED STATES	AK	SNETTISHAM	3H

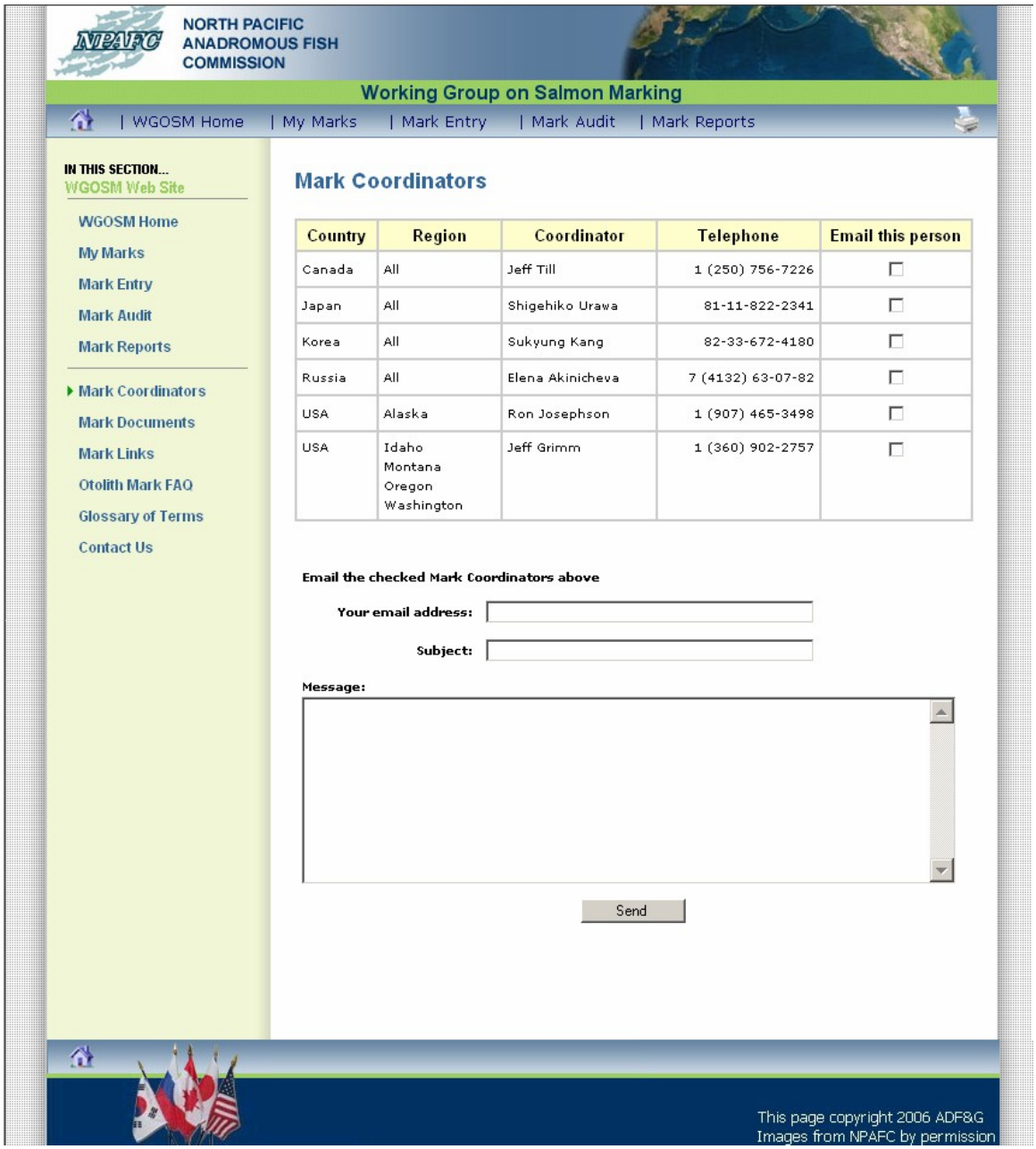
The results of the query for hatch code 3H sockeye from the USA are displayed here as a list of matching items. The blue entries in the Local Mark ID column are hypertext links to detailed marking records.



These original marking details were brought up by clicking on its associated hyperlink in the Marks on File list.



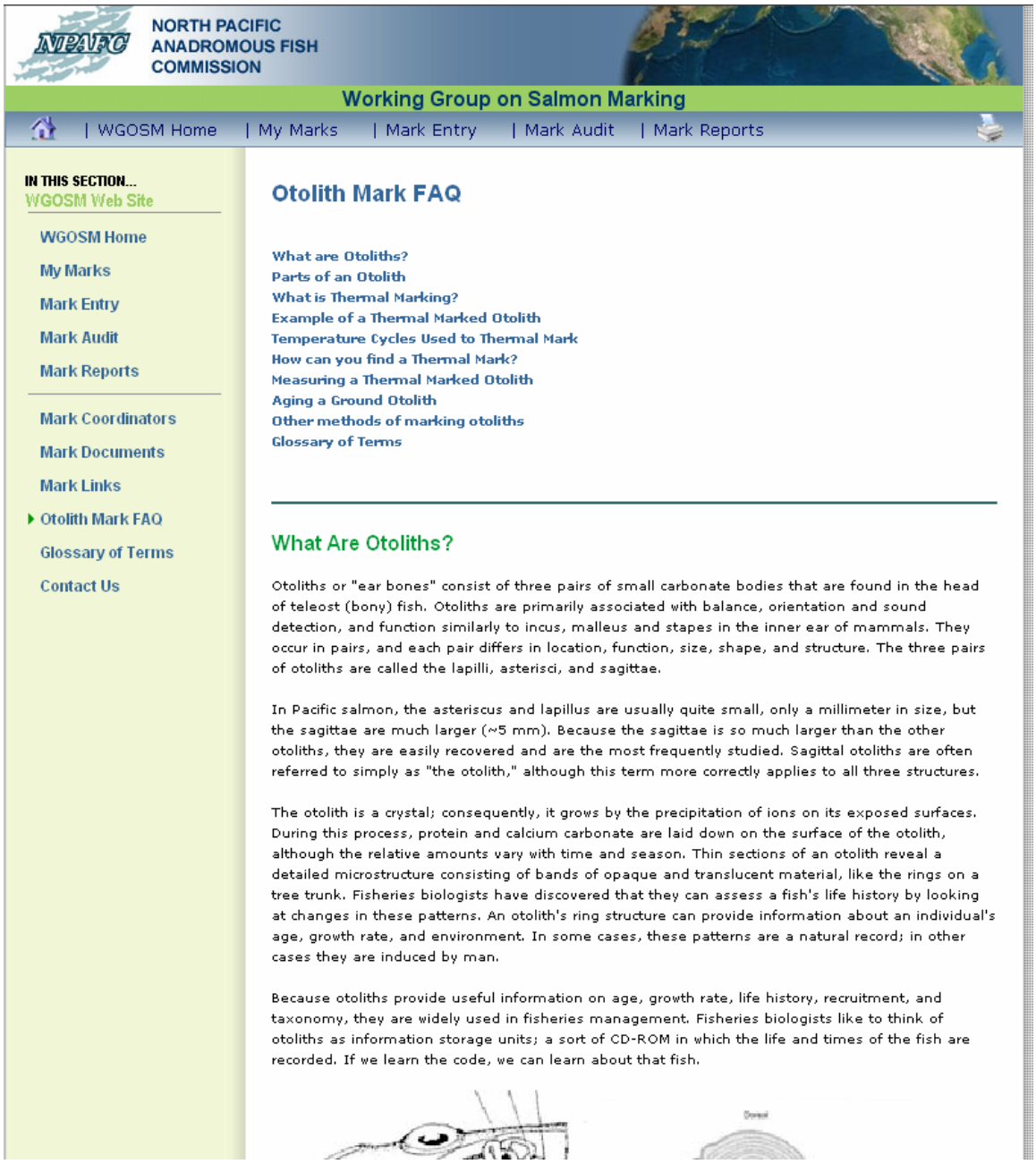
http://npafc.taglab.org/MarkAudit.asp lists those records whose hatch code has not yet been verified and is, instead, "tentative". The hatch code needs to be verified for certain records brought in from legacy databases. The code also need to be verified when its particular pattern is used for the very first time. Verification is done by bringing the record up for edit, confirming the hatch code, and resaving it. The report items drawn in blue are links that open the named mark record for updating.



http://npafc.taglab.org/MarkCoordinators.asp documents the Mark Coordinators responsible for managing and reporting induced marks from their jurisdictions. It may also be used to send emails to coordinators. (Email addresses are not directly written on the web page in order to prevent spam operators from obtaining them.)

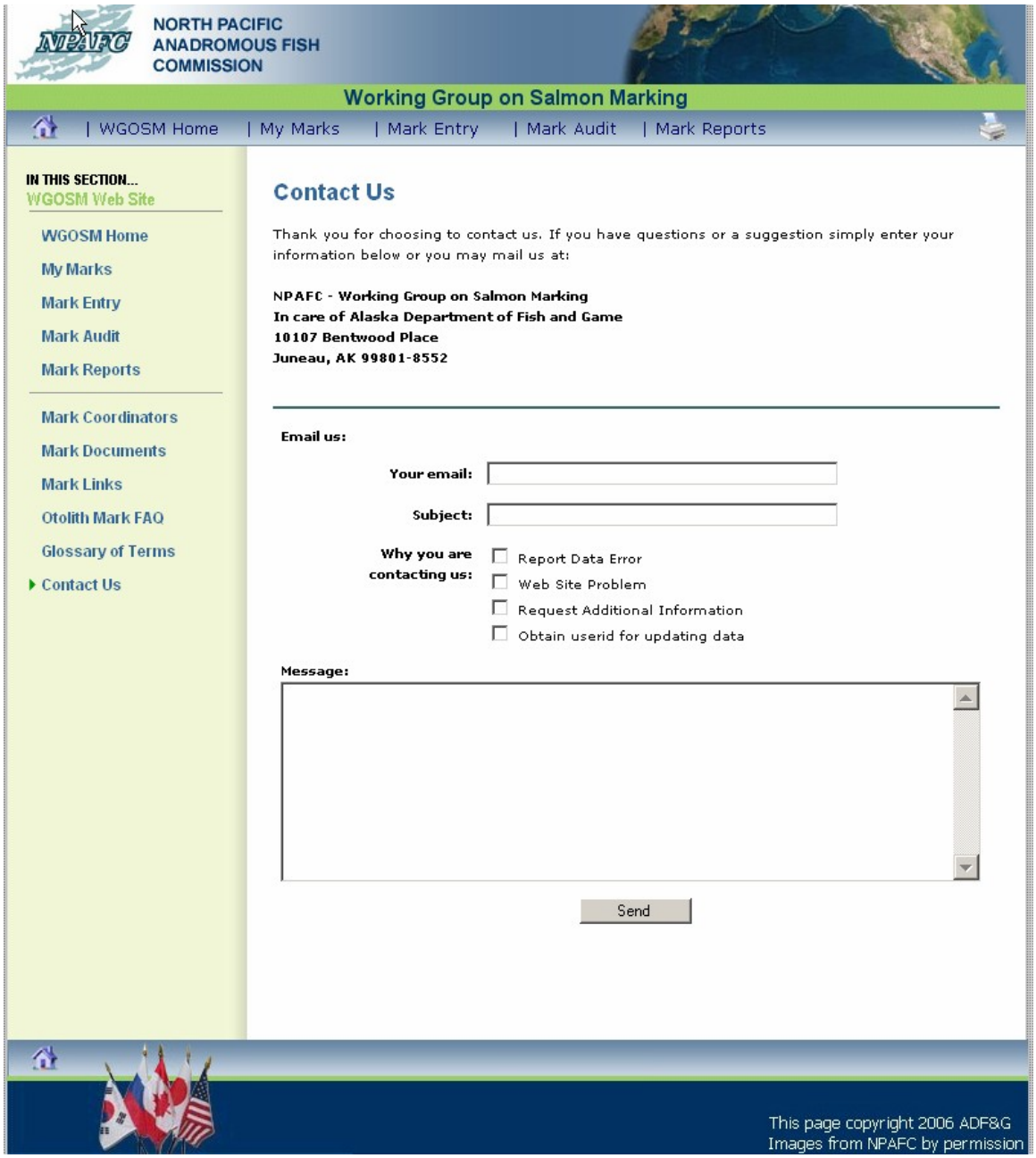
http://npafc.taglab.org/MarkDocuments.asp is shown here. It highlights NPAFC documents on salmon marking.

http://npafc.taglab.org/MarkLinks.asp notes other web sites related to otolith marking.



http://npafc.taglab.org/MarkFAQ.asp answers frequently asked questions.

http://npafc.taglab.org/glossary.asp tersely defines technical terms used in otolith marking.



http://npafc/taglab.org/ContactUs.asp may be used to contact the web site staff in order to work out details for effectively using the system.