

# eOto

## Otoliths in the 21<sup>st</sup> Century



- Mark, Tag, and Age Laboratory
- Coded Wire Tag Lab
- Otolith Processing Lab
- Age Determination Unit

- Timothy Frawley
  - Started in 2001 working for CWT Lab
- We quickly grew bored so we expanded
  - Juneau and Cordova Otolith recovery applications
  - Otolith Vouchering application
  - Otolith Release tracking





# Coded Wire Tag Laboratory

How does CWT data collection  
affect Otoliths?



## Track Salmon Releases

- Tagged and/or Marked (CWT)
- Not Tagged and/or Marked (Non-CWT)



# How has technology improved the process of tracking salmon releases

## Alaska Department of Fish and Game Non-CWT Release Information Form

RELEASE IDENTIFIER (1/Form) **112016PWSA03**  
(Leave blank - assigned by Tag Lab)

### GENERAL INFORMATION

Project Leader: Reggiani Species (common name): Pink Rearing Type:  Hatchery  
 Agency: PWSA Brood Year: 2000  
 Division/Section (where raised): AF Koernig Stock: AF Koernig Release Type:  Experimental  
 Facility: AF Koernig Ancestral Stock (if from): AF Koernig  Production  
 Run (Leave Experimental Narrative blank if Thermal Mark Type = Production) Thermal Mark Code: 1:1.4+2.3  
 Experimental Narrative (only): 1:1.4+2.4

Mark Type: (When Fish Mass Marked by Pin-Clipping)  TM Thermal Mark  
 LV - Left Vessel LV + TM - Left Vessel + Thermal Mark RV + TM - Right Vessel + Thermal Mark  
 RV - Right Vessel VI - Visual Implant Other:

### RELEASE INFORMATION

Supervisor of Release: \_\_\_\_\_ Release Stage:  emergent by  fed by  fingerling  presmolt  smolt  adult  
 Release Site: Sawmill Bay 226-40 Non-CWT Fish Counting Method:  actual count  feed conversion  Paterson estimate  volumetric  weight estimate  
 Habitat Stream #: \_\_\_\_\_ Expected Survival:  normal  fish destroyed  serious problem

Size at Release (Weight (g) / Fork Length (mm))  
0.48 / 5-23-01 - 5-23-01  
 Release Dates (Begin/End)  
5-23-01 - 5-23-01  
 Total # Fish Released (NOT Marked & NOT Registered by)  
73,346, 557

### COMMENTS

Data Source: 2001 AF Koernig AFCPR 8-1.  
 100% Thermal Marked.  
 Split to 2 groups

Form Completed by: D.M.B. H.S. Date: 2-8-2002 Form Entered by: DB

State of Alaska | myAlaska | My Government | Resident | Business in Alaska | Visiting Alaska | State Employees

Alaska Department of Fish and Game

Home | Fishing | Hunting | Viewing | Education | Species | Lands/Waters | Regulations

Non-CWT Online Release Entry

Release ID Code: 112016PWSA03 [Retrieve] [Save] [Clear] [Delete]

Release ID Code: 112016PWSA03 has been finalized and may not be modified.

General Information

Project Leader: REGGIANI Species: PINK Rearing Type: HATCHERY  
 Agency: PWSA Brood Year: 2000 Release Type: PRODUCTION  
 Division/Section: AF KOERNIG Adult Run: - Select - Mark Type: TM  
 Facility: A F KOERNIG Stock: A F KOERNIG Thermal Mark: - Select -  
 Ancestral Stock: - Select - Experimental Class: - Select -

Non-CWT Release Information

Release Supervisor: \_\_\_\_\_ Release Stage: FED FRY  
 Release Site: SAWMILL BAY 226-40 Unmarked Counting Method: - Select -  
 Stream #: \_\_\_\_\_ Expected Survival: NORMAL

Size at Release: Weight (g) 0.48 Fork Length (mm) \_\_\_\_\_ Began: 5/23/2001 Ended: 5/23/2001 Total Fish Released: 36,173,278

Comments: 250 characters max.  
 NO THERMAL MARKS RELEASED ON 5/23 TOTAL NUMBER REPORTED 50% ATTRIBUTED TO EACH MARK GROUP (SEE 112016PWSA02)

Submit Release as Final Version [Save] [Create New Release ID] [Printer Friendly]

Non-CWT Release Summary as of most recent save for Release Year: 2001, Agency: PWSA, and Facility: A F KOERNIG  
 Show all facilities for Agency: PWSA

Facility: A F KOERNIG	Release ID	Brood	Species	Release Site	Release Dates	Stock	Fish Released
	112016PWSA01	2000	PINK	SAWMILL BAY 226-40	5/7/2001	A F KOERNIG	77,941,373
	112016PWSA02	2000	PINK	SAWMILL BAY 226-40	5/23/2001	A F KOERNIG	36,173,278
	112016PWSA02	2000	PINK	SAWMILL BAY 226-40	5/23/2001	A F KOERNIG	36,173,278
	2000 Sub Total:						150,287,930
	A F KOERNIG Grand Total:						150,287,930

Tell ADF&G how to make this work better for you

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# Salmon Release Visual Aid

<http://www.taglab.org/CWT/Reports/map-facility.asp>

Map Satellite Hybrid

Facility Releases

Species	Production	Years
COHO	1,619,440	1981 - 1995
CHUM	5,056,391	1977 - 1995
CHINOOK	671,102	1981 - 1986

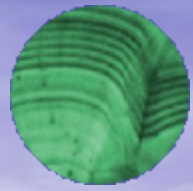
**FACILITY**  
CLEAR

**RELEASE SITES**  
CLEAR CR 334-40  
JUNE CR 334-40  
SUSHANA R 334-40  
WOOD CR 334-40

**NOTES**

- Contents reflect information only for brood years 1967 through 2011.
- Release groups that could not be displayed due to missing coordinates: 0.
- Production counts for Alaska are complete. Counts for other states/provinces reflect only CWT-represented releases.

Google  
© 2011 TerraMetrics, Map data © 2011 Google - Terms of Use



# Otolith Recovery Laboratory

## In-Season and primary purpose

- Track Otolith Marked Salmon Releases
- Record Marked Otolith Recovery
- Report Otolith Recovery efforts

## Off-Season projects

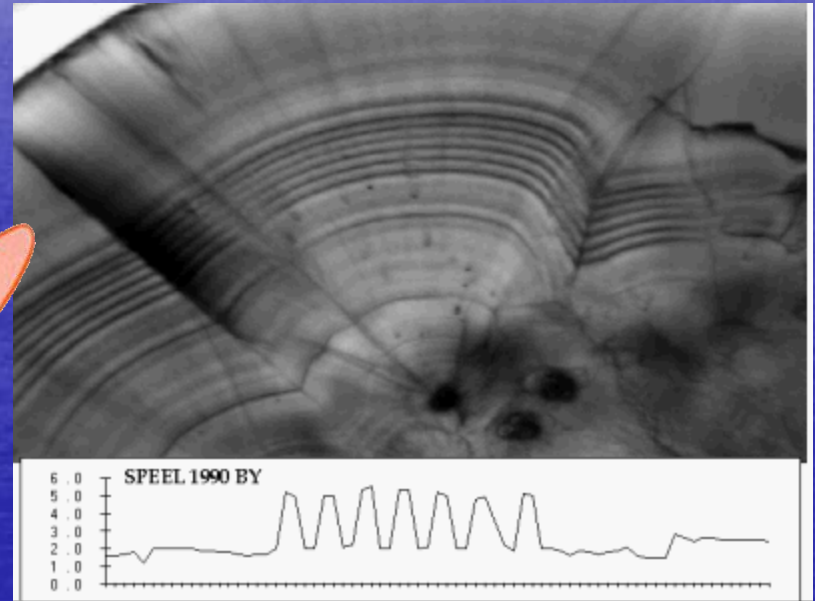
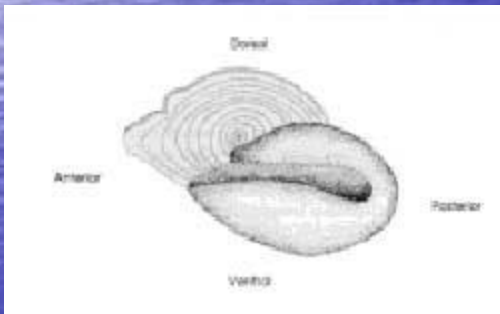
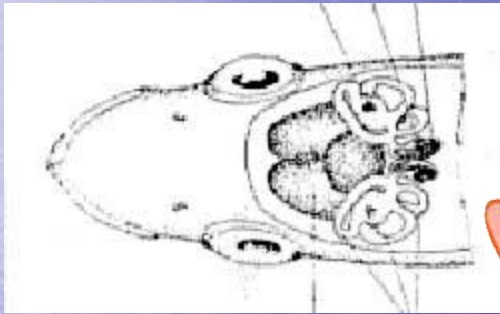
- Voucher Hatchery Otolith Marks
- Scale Imaging, Digitizing and Analysis
  - Age, Sex, Length and Scale matched data
- Coordinate Mark Assignments Throughout the Pacific Rim



# What is an Otolith and how do you mark it?

An Otolith is a fishes ear bone

Temperature changes induce a mark pattern



<http://npafc.taglab.org/MarkFAQ.asp>

# Voucher Hatchery Otolith Marks







# Why the Vouchers are so important

## International Community

**NPAFC** NORTH PACIFIC ANADROMOUS FISH COMMISSION

Working Group on Salmon Marking

WGOSM Home | My Marks | Mark Entry | Mark Audit | Mark Reports

### NPAFC Mark Detail

Local Mark Name:  Active:  NPAFC ID:

---

#### General Information

Country:  Species:   
 State/Province:  Brood Year:   
 Region:  Run:   
 Agency:  Stock:   
 Facility:

---

#### Mark Information

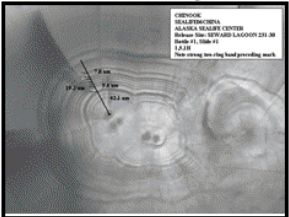
Otolith Mark(s):  A  C  D  S  T  X

Fin Mark(s):  AD  AN  CD  D  FB  LM  LP  LV  
 RM  RP  RV

Coded Wire Tag(s):

Hatch Code:   
 RB#:   
 Thermal Mark Schedule:   
 Temperature Shift:

Mark Comment:  
 ALL MARKS ARE PRECEDED BY A TWO-RING BAND THAT EXHIBITS A VARIED SPACING.

Otolith Master Image:  


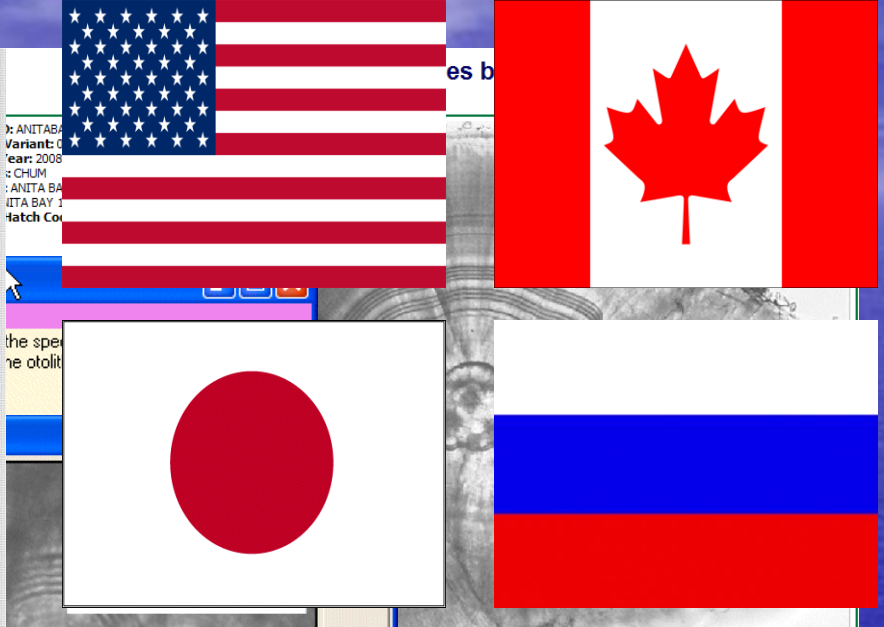
---

#### Release Information

Responsible Person:   
 Contact Email:   
 Date Last Released:  Stage:   
 Release Year:  Length:  mm  
 Number Released:  Weight:  grams

All Sites:

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es b

x: ANITAB  
 Variant: 0  
 Year: 2008  
 s: CHUM  
 : ANITA BA  
 ITA BAY 1  
 Hatch Co

the spe  
 ne otolit

house  
 olications

used by Juneau, Cordova

About

CHUM ANITABAY08 NEETS BAY Bottle #2, Slide #4 2,4H VARIANT: Actual mark is 1,3,4H, but some lots showed a 2,4H. First ring may be hard to detect and the third ring in band two can fade.

25 um

# Tracking Otolith Marked Salmon Releases

## North Pacific Anadromous Fish Commission

### Working Group on Salmon Marking

<http://www.npafc.taglab.org>



**NPAFC** NORTH PACIFIC ANADROMOUS FISH COMMISSION

Working Group on Salmon Marking

WGOSM Home | My Marks | Mark Entry | Mark Audit | Mark Reports

### NPAFC Mark Repository Update

Local Mark Name: TATSAMENIE06S Active:  NPAFC ID: AK06-63 [Retrieve] [Save] [Clear] [Delete]

**General Information**

Country: UNITED STATES Species: SOCKEYE  
State/Province: ALASKA Brood Year: 2006  
Region: SOUTHEAST Run: -Select-  
Agency: DIPC Facility: SNETTISHAM Stock: -Select-

**Mark Information** [Help]

Thermal/Dry  Alizarin  Calcein  Strontium  Hatch Mark

Otolith Mark(s):  
 A  C  D  S  T  X

Fin Mark(s):  
 AD  AN  CD  D  FB  LM  LP  LV  
 RM  RP  RV

Hatch Codes: 2,2,3H  
RBr: 1:1,2,2,2,3,3

Thermal Mark Schedules:  
Temperature Shift:

Mark Comment:

**Release Information**

Responsible Person: BEV AGLER Site: -Select-  
Contact Email: BEV.AGLER@ALASKA.GOV All Sites: R-TATSAMENIE LK  
Date Last Released: 6/7/2007 Stage: FED FRY  
Release Year: 2007 Length: mm  
Number Released: 792910 Weight: 0.17 grams

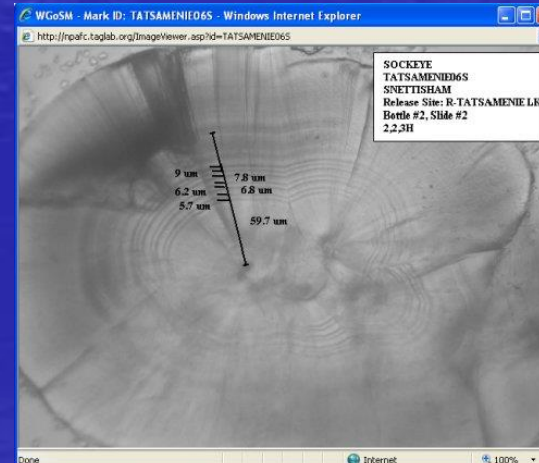
[Save] [Save and return to My Mark] [Create New Mark ID] [Save and Print]

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Standardized Marking Methodology

Coded Wire Tag data matching

Otolith Mark Imaging visual aids



# Coordinate Mark Assignments



Alaska – USA  
 Canada  
 Japan  
 Korea  
 Russia

We assist in the coordination of mark plans in order to avoid duplication.

AGENCY	FACILITY	STOCK	FINAL RELEASE SITE	STAGE	BY 04 Hatch code	BY 05 Hatch code	BY 06 Hatch code	BY 07 Hatch code	BY 08 Hatch code
PWSAC	Wally H. Noerenberg Hatch	Wally H. Noerenberg	Wally H. Noerenberg	Fed Fry	8H5	8H5	8H5	8H5	8H5
SSRAA	Neets Bay Hatchery	Neets Bay	Anita Bay	Fed Fry	1,3n,2nH	1,3,3,1H	3,4,1H	1,5,2H	1,3,4H
DIPAC	Macaulay Hatchery	Macaulay	Juneau Area	Fed Fry	4H	6H	4,1H	4H	6H
NSRAA	Medvejie Hatchery	Medvejie	Deep Inlet	Fed Fry				1,2n,4H	3,1,3H
SSRAA	Neets Bay Hatchery	Neets Bay	Nakat Inlet	Fed Fry	3,2n,2nH	3,2,3H	3,1,4H	4,3,1H	3,2,3H
NSED	Nome Incubation	Snake River	Snake River	Egg		2/1H	3n,2H	3H	
NSRAA	Hidden Falls Hatchery	Hidden Falls	Kasnyku Bay	Fed Fry	4,2H	3,3,1H	1,2,2,2H	3,4nH	3,3,1H
SSRAA	Neets Bay Hatchery	Neets Bay	Nakat Inlet	Fed Fry	1,4n,2H		1,6,1H	3,4,1H2	3,4,1H4
NSRAA	Medvejie Hatchery	Hidden Falls	Deep Inlet	Fed Fry	3,3H	3n,2,2nH	4,2n,1H	5,2nH	3n,2,2nH



# What does combining data do for us?

- Common coding provides data portability.
  - I can match your data to my data in a meaningful way.
- Data can be shared between systems.
  - Region 1 Scale Aging data relates Otolith Recovery data for age comparison.
- Validate information by cross-referencing data.
  - Multiple projects use each others information for comparative research and/or validation.
  - Fisheries Management using differing data sets and techniques can compare accuracy and precision.
  - Information from disparate sources lead to new understanding.

# Recording Otolith Mark Recovery



# How has technology improved the process?

Past efforts for relating  
Otolith and Brain Parasite  
data.

- Pen and Paper
  - Transcription Errors



# Today's method uses mobile computers

- Light weight
- Ruggedized
- Programmable
- Versatile
- Audible Feedback
- Wireless communication
- Immediate Data Validation



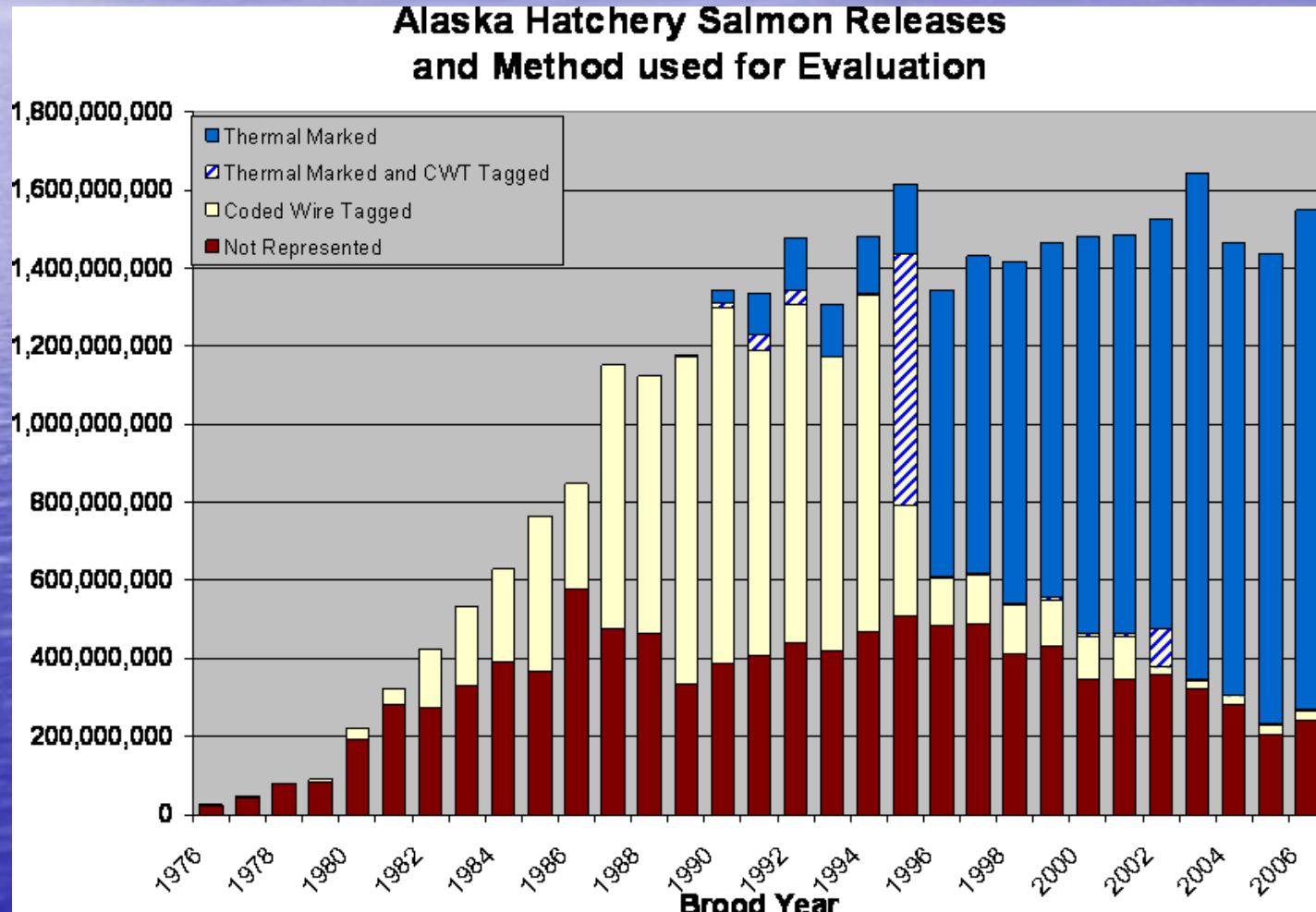


# Mobile computing and data collection





# Salmon Marking efforts 1976 to 2008



# Prince William Sound

## Marked Otolith Recovery

- Uses an identical recovery methodology to that of Juneau
- Application supported by CWT Information Technology Team since before 2000
- PWS utilizes Access databases due to poor connectivity and lack of funds
- Latest capabilities as of 2008 include
  - Matched data samples (ASL, Genetic, Straying)
  - GPS tracking for Straying studies
  - Catch retrieval on demand from MARINER
- No online reporting capability





# Age Determination Unit

- Age and Measure Ground Fish Otoliths and Invertebrate species
- Age data released to Fisheries Managers for stock estimation
- ASL data integration from IFDB

# Age and Measure Ground Fish Otoliths and Invertebrate species



Otoliths are measured for Length and Weight



Otoliths are then prepped and aged



<http://www.taglab.org/ADU/GeneralTechniques.asp>

# ADU Data Entry System: AegIS



Steve Gebert created the very first version of AegIS. The name comes from Greek Mythology, meaning literally "goat skin". An AegIS later came to mean shield or protection.

To this day the shield of Zeus, his "Aegis", can be seen in the application when an unexpected error occurs.



# AegIS – “Age is”

Today AegIS contains:

- 5,000 Samples
- 155,00 Specimens from 10 species
- 113,000 matched IFDB ASL Specimens
- 153,000 Age Readings
- 104,000 Released Age Readings

Not bad for an operation who's primary data storage system was Excel, just under five years ago.



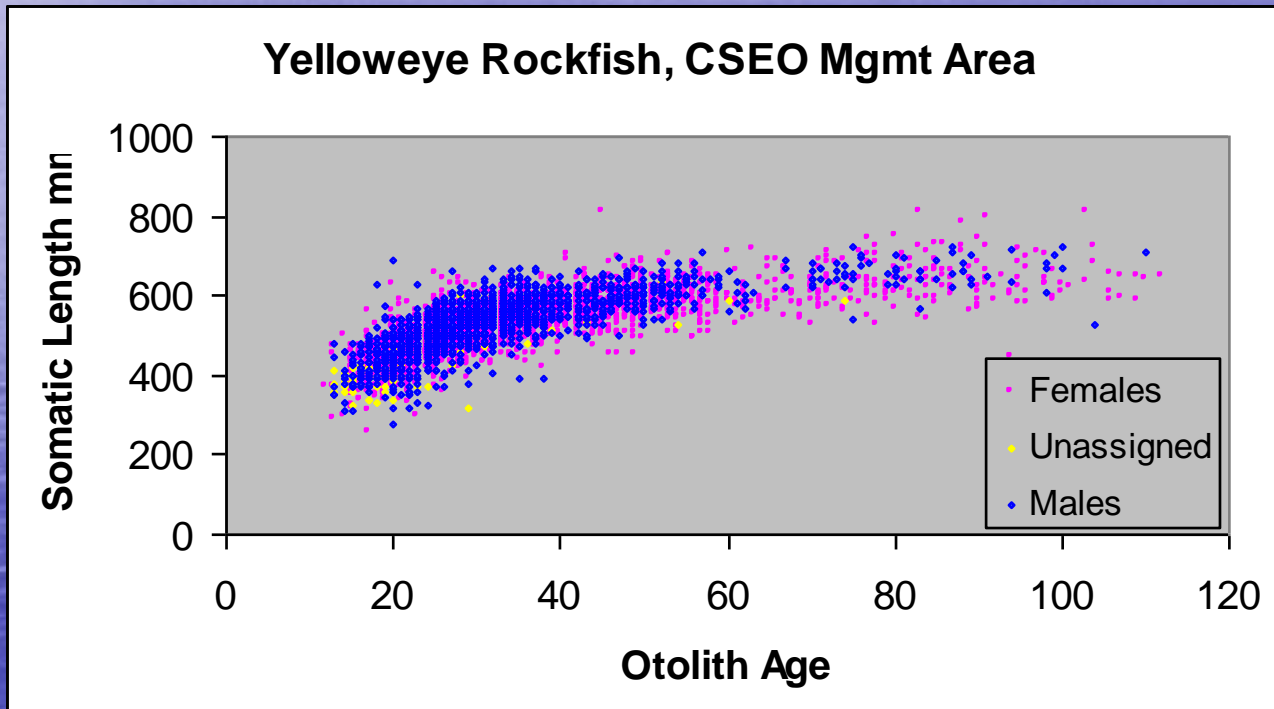
# Age data released to Fisheries Managers

January thru June 2008 specimens received, aged, verified and released

	Region I (SE)		Region II (SC)		Region IV(WW)		All Regions
	# species	# specimens	# species	# specimens	# species	# specimens	
Age Structures Received	8	2,613	5	1,285	2	196	4,094
Specimens Measured	8	12,279	7	3,628	3	392	16,299
Primary Age Data	8	3,781	5	861	3	196	4,838
Precision Test Data	5	767	6	133	1	27	927
Released Age Data	6	3,704	5	424	3	196	4,324

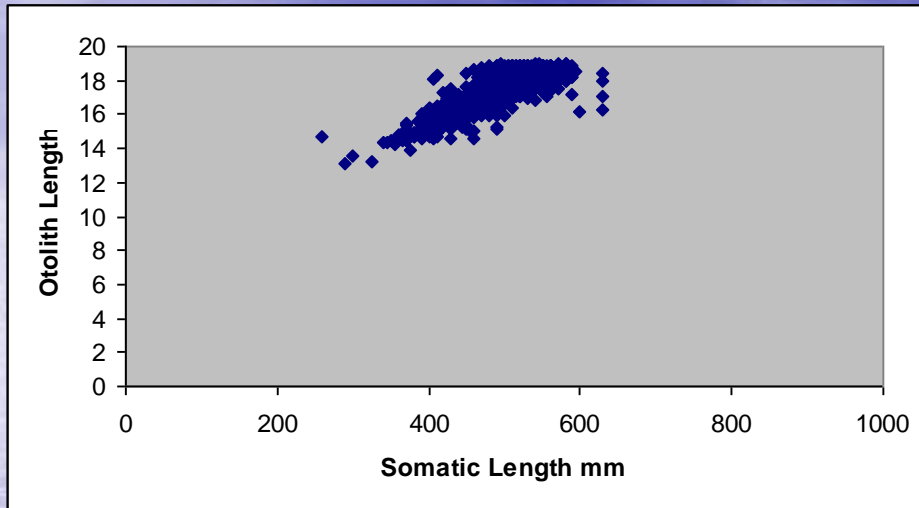
Other data, for example "specimens measured" and "precision test data" are all part of our internal process (not released to managers). This table doesn't capture 100% of all data or program output, only that precisely recognized by our data service mandate.

# Ground fish ASL data integration from IFDB



A "simple" age-length curve that can be generated by extracting both age and somatic length data from AegIS and IFDB

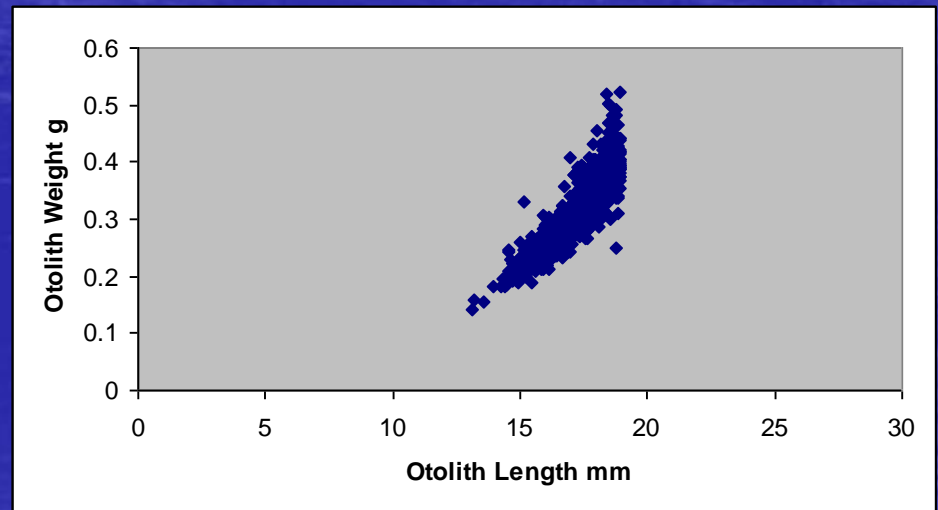
# Other AegIS data uses



A simple comparison of our age-structure measurement data correlating the Somatic Length to the Length of an Otolith.

Classic "bomb radiocarbon curve", and how our age data for the species dusky rockfish tested against the curve. These results are very good.

We have radiocarbon data for approximately 13 species of ground fish and invertebrates which we age.



## Age Sex Length Inventory Form

**Instructions:**

Use the following fields to narrow the scope of your report. Use the checkboxes to select acceptable values for each field. Leaving a given field blank (not selecting any checkboxes or not entering any text) will allow all possible values of that field to be included. When you are done, click the "Run Report to Screen" or "Run Report to File" buttons.

**Years:**

- 2003  2002  2001  2000  
 1993  1992  1991  1990  
 1983  1982  1981  1980  
 1973  1972  1971  1970  
 1963  1962  1961  1960

**Species:**

- CHINOOK  CHUM  COHO

**Districts:**

- 101  102  103  104  
 111  112  113  114  
 171  172  
 189  191  
 224  225  
 249  251  
 262  271  
 302  303  
 320  321  
 334  335

## Age Sex Length Availability

**Legend:**

- Data validated and available
- Submitted - unavailable until corrected
- Not yet submitted to repository
- Never collected

Date Year	Region I Southeast	Region II Southcentral	Region III A-Y-K	Region IV Westward
2007	03/11/2008			

## Age Sex Length Sample Detail Form

**Instructions:**

Use the following fields to narrow the scope of your report. Use the checkboxes to select acceptable values for each field. Leaving a given field blank (not selecting any checkboxes or not entering any text) will allow all possible values of that field to be included. When you are done, click the "Run Report to Screen" or "Run Report to File" buttons.

**Years:**

- 2007  2006  2005  2004  2003  2002  2001  2000  1999  1998  
 1997  1996  1995  1994  1993  1992  1991  1990  1989  1988  
 1987  1986  1985  1984  1983  1982  1981

**Species:**

- 410  420  430  440  450

**Region:**

- 1  2

**Districts:**

- 101  102  103  104  105  106  107  108  109  110  111  
 112  113  114  115  116  181  182  183  185  189  191  
 192  284  285  314  320  321  322  324  325  326

**Harvest:**

- EXPERIMENTAL AREA  M-I-C  PNP FISH  
 TERMINAL AREA  TEST RUN ASSESSMENT  TEST SPECIAL STUDY  
 TRADITIONAL

**Gear:**

- 01  02  03  04  05  08  12  13  14  2  3  30  4  71  
 73  77  90

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### Mark, Tag, and Age Laboratory

ADF&G - Division of Commercial Fisheries  
[Comm Fish Home](#)

[ASL Report Home](#)

## Age Sex Length Repository - Overview

### ASL Inventory Report

The ASL Inventory Report summarizes which Alaska salmon have been data are currently dispersed across a number of offices, locations, and to capture the Age-Sex-Length data in a standardized format, and make files. The Inventory Report lists the current scope of known salmon ASL

### ASL Specimen Report

Individual biological observations are detailed in this report. It may be filtered by a number be shown on your screen, with a row limit in effect to protect your browser from overloading; file for subsequent analysis using tools like Excel.

### ASL Detailed Specimen Report

Individual biological observations are also detailed in this report. The report may be show limit in effect to protect your browser from overloading. It may also be generated as a file for tools like Excel. All 45 columns of the standardized data format are included in this report, columns may be used for filtering. Since sampling methods have somewhat diverged over areas, there are usually cells where some data are uncollected and appear blank.

### ASL Availability Report

Alaska salmon Age-Sex-Length data are in the process of being identified, edited and inst are submitted to the repository in packages, each of which covers the total ASL data collected single year. As each package is submitted, it is validated. A package that passes the standard in the repository. This report explains which packages are currently available for retrieval.

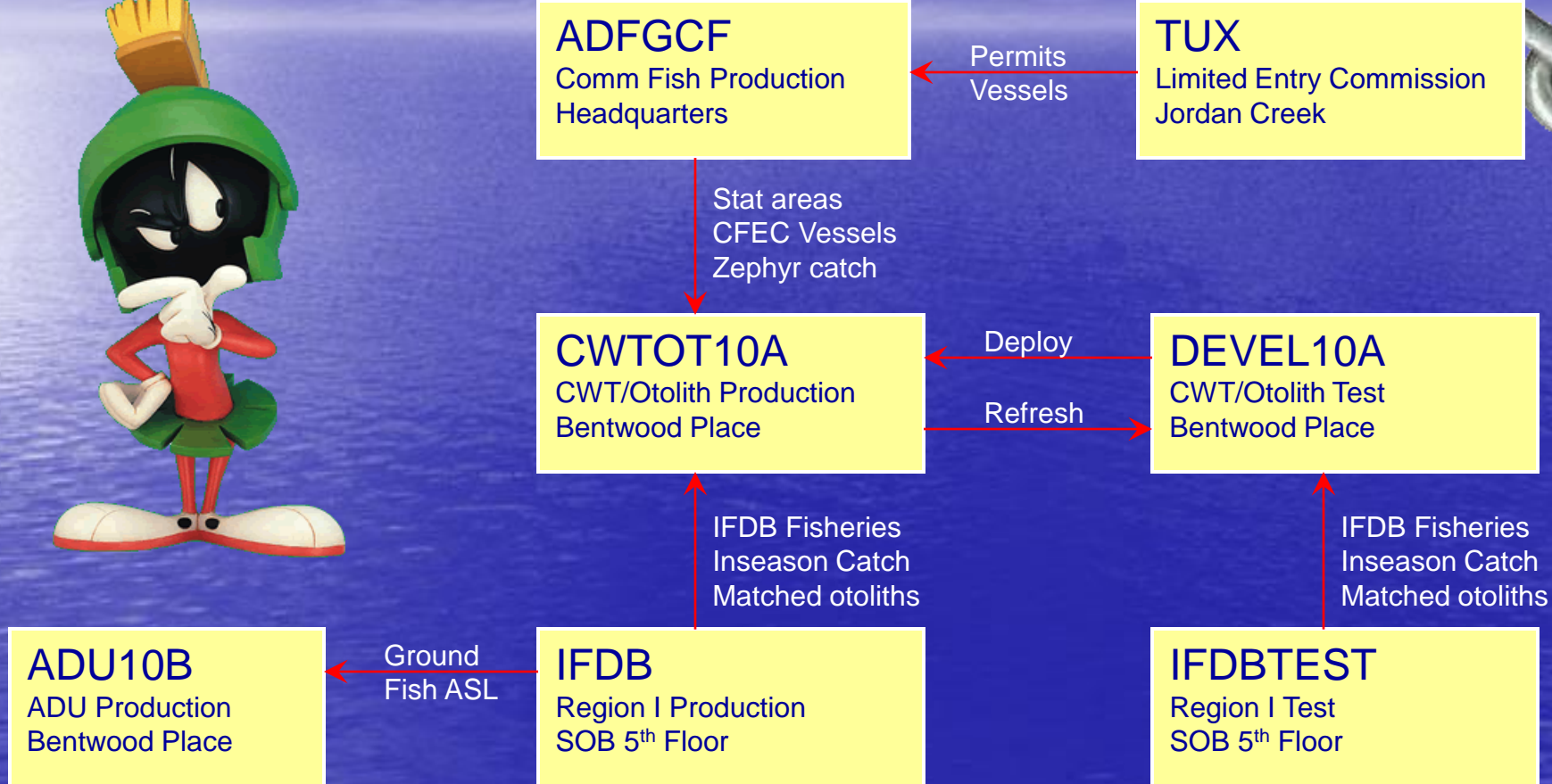
### Data Submission Specification version CF-2.0

Data are submitted to the repository by all regions using a single common format. The example format is available as a PDF document. (Adobe Reader software is required to view this document)

### Schematic of Repository Data Flow

An illustration of how annual data are submitted from regions, validated, installed and made available

# Oracle DB Link Integration



**"That's  
all  
folks!"**

