Agenda for TRRP Adult Salmonid Monitoring Review work shop, October 26-28, 2011.

Wednesday, October 26			
Start	End	Presentation	Presenter
9:00 AM	9:15 AM	**Introduction, review purpose of the workshop**	Ernie Clarke/ Joe Polos
9:15 AM	9:30 AM	Overview of TRRP adult assessments	Joe Polos
9:30 AM	9:35 AM		
9:35 AM	9:55 AM	**Run Size and Angler Harvest - JC and WC weirs**	Wade Sinnen
9:55 AM	10:10 AM	Q&A	
10:10 AM	10:30 AM	Break	
10:30 AM	10:50 AM	**Coded Wire Tagging/marking (Chinook, coho and sth)** (combined with recovery presentation that was to follow)	George Kautsky/ Wade Sinnen
10:50 AM	11:05 AM	Q&A	
11:05 AM	11:10 AM		
11:10 AM	11:30 AM	CWT recovery/decoding @ hatchery	Wade Sinnen
11:30 AM	11:45 AM	Q&A	
11:45 AM	1:00 PM	**LUNCH**	
1:00 PM	1:20 PM	**Recreational Harvest on lower Trinity**	George Kautsky
1:20 PM	1:35 PM	Q&A	
1:35 PM	1:40 PM		
1:40 PM	2:00 PM	**Recreational Harvest on lower Klamath**	Sara Borok
2:00 PM	2:15 PM	Q&A	
2:15 PM	2:35 PM	**Break**	
2:35 PM	2:55 PM	**Tribal Harvest on lower Klamath - Yurok**	Dave Hilleimer/Desma Williams
2:55 PM	3:10 PM	Q&A	
3:10 PM	3:15 PM		
3:15 PM	3:35 PM	**Tribal Harvest on Trinity - Hoopa**	George Kautsky
3:35 PM	3:50 PM	Q&A	
3:50 PM	4:30 PM	**Wrap up for the day - unanswered questions**	Joe Polos
Thursday, October 27			
Start	End	Presentation	Presenter
9:00 AM	9:20 AM	**Age Composition**	George Kautsky/ Desma Williams
9:20 AM	9:35 AM	Q&A	
9:35 AM	9:40 AM		
9:40 AM	10:00 AM	**Cohort Reconstruction**	George Kautsky
10:00 AM	10:15 AM	Q&A	
10:15 AM	10:35 AM	**Break**	
10:35 AM	10:55 AM	**Mainstem Carcass Survey**	Andy Hill
10:55 AM	11:10 AM	Q&A	
11:10 AM	11:15 AM		
11:15 AM	11:35 AM	**Redd Survey**	Charlie Chamberlain
11:35 AM	11:50 AM	Q&A	
11:50 AM	1:00 PM	**Lunch**	
1:00 PM	1:20 PM	**Adult Fish Health**	Tim Hayden/ Josh Strange
1:20 PM	1:35 PM	Q&A	
1:35 PM	1:40 PM		
1:40 PM	3:30 PM	**Unanswered questions/Discussion/Summary/Wrap-up**	Ernie Clarke/ Joe Polos
Friday, October 28			
8:00 AM		Field Trip - meet at FWS office - bring a lunch	
		Sites to be determined	

TRRP Adult Salmonid Monitoring Evaluation

Trinity River Restoration Program

Work Shop

October 26-28, 2011

Arcata, CA

Purpose of the Trinity River Restoration Program's Adult Salmonid Monitoring Evaluation

- Conduct an independent review and evaluation of the existing adult salmonid assessments that the Program supports
- Evaluate their effectiveness and precision of estimates relative to meeting the information needs of the Program's Adaptive Environmental Assessment and Management process
- Recommend any changes as appropriate.

TRRP is a Multi-Agency Effort

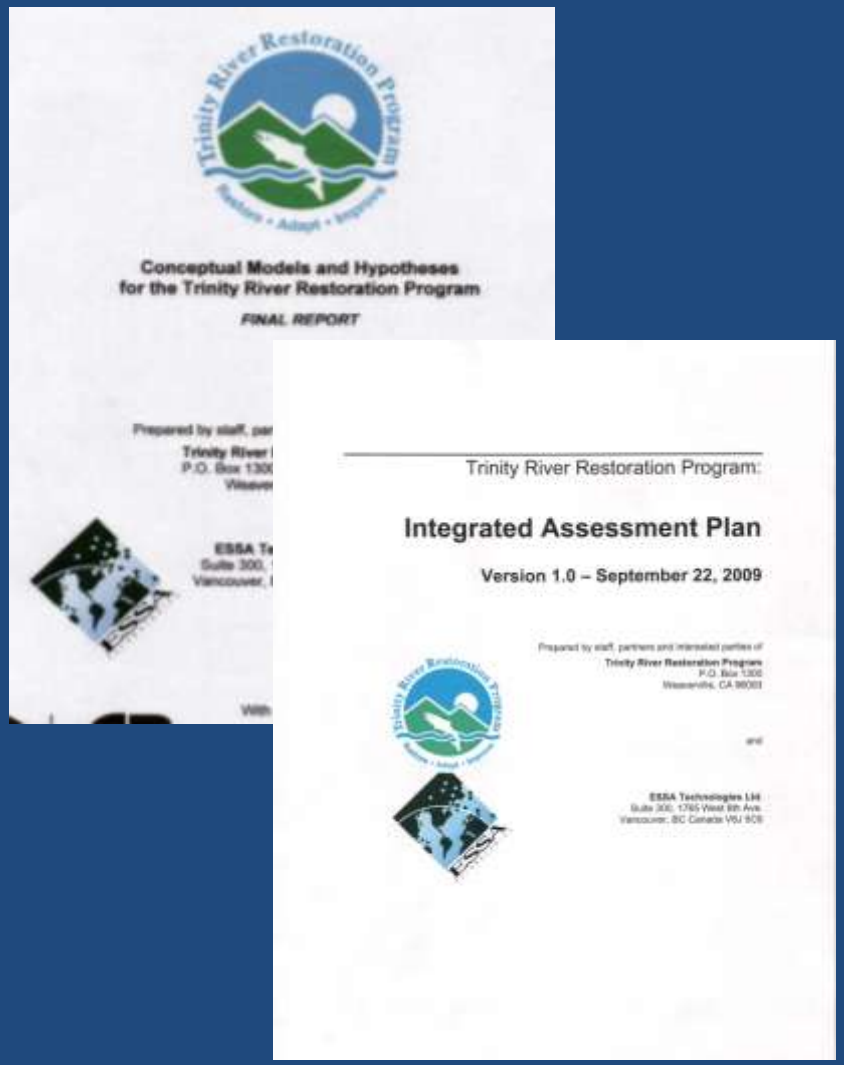
TRRP Goal

Goal: Restore and sustain natural production of anadromous fish populations downstream of Lewiston Dam to pre-dam levels, to facilitate enhanced harvest opportunities by dependent tribal, commercial, and sport fisheries' full participation in the benefits of restoration via enhanced harvest opportunities.

Strategy: Restore riverine habitats by restoring the processes that produce a healthy alluvial river ecosystem.

The above restoration strategy will be achieved by implementing management actions in a science-based adaptive management program.

Conceptual Models & Hypotheses and Integrated Assessment Plan

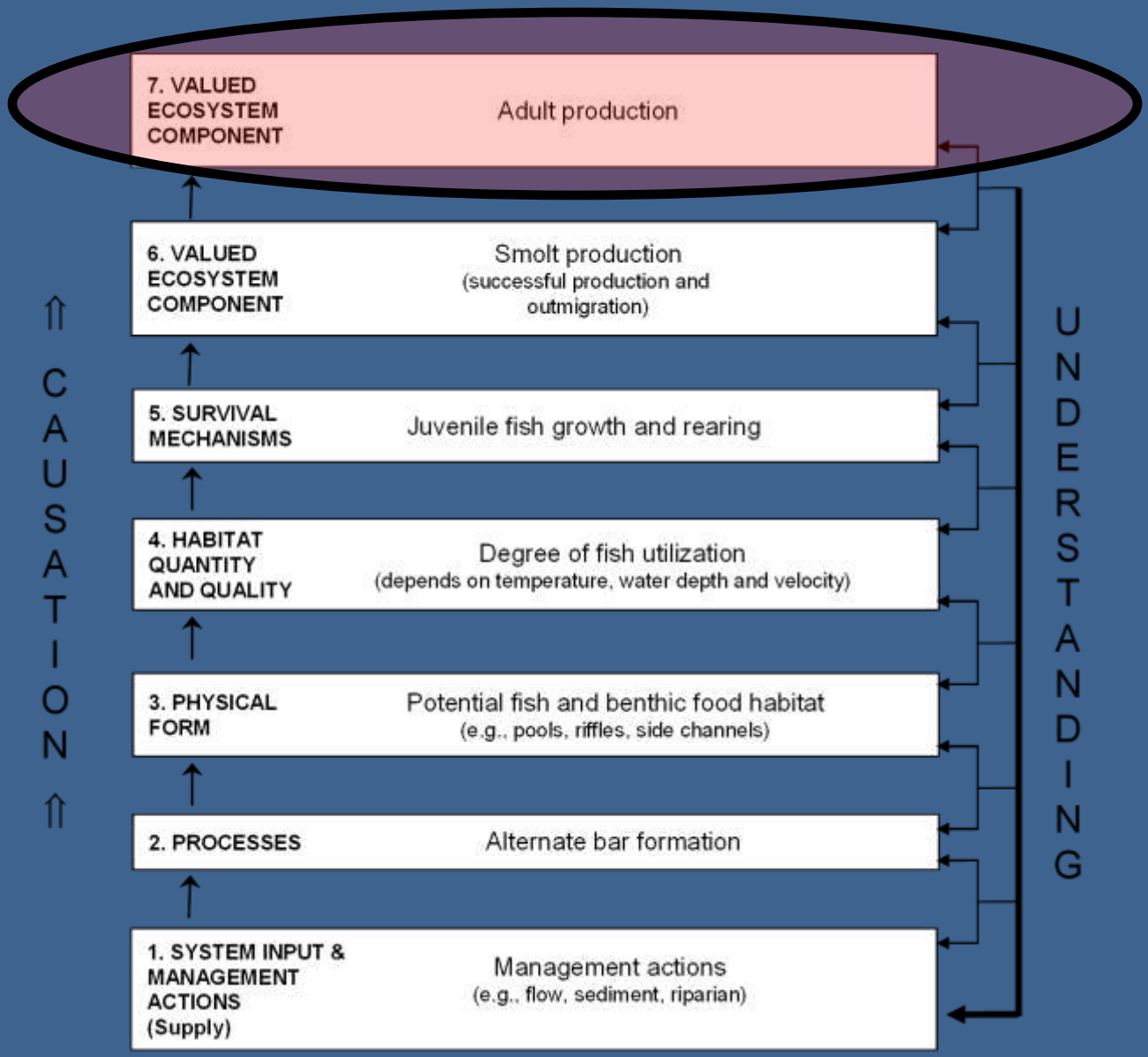


Documents were developed from 2004-2009 to guide monitoring and evaluation of the TRRP.

Identified assessments and timelines for conducting various monitoring activities.

Conceptual Model of Restoration Strategy

Cause and effect linkages that lead from TRRP management actions through changes in fluvial geomorphic processes, physical form, habitat utilization and biological responses.

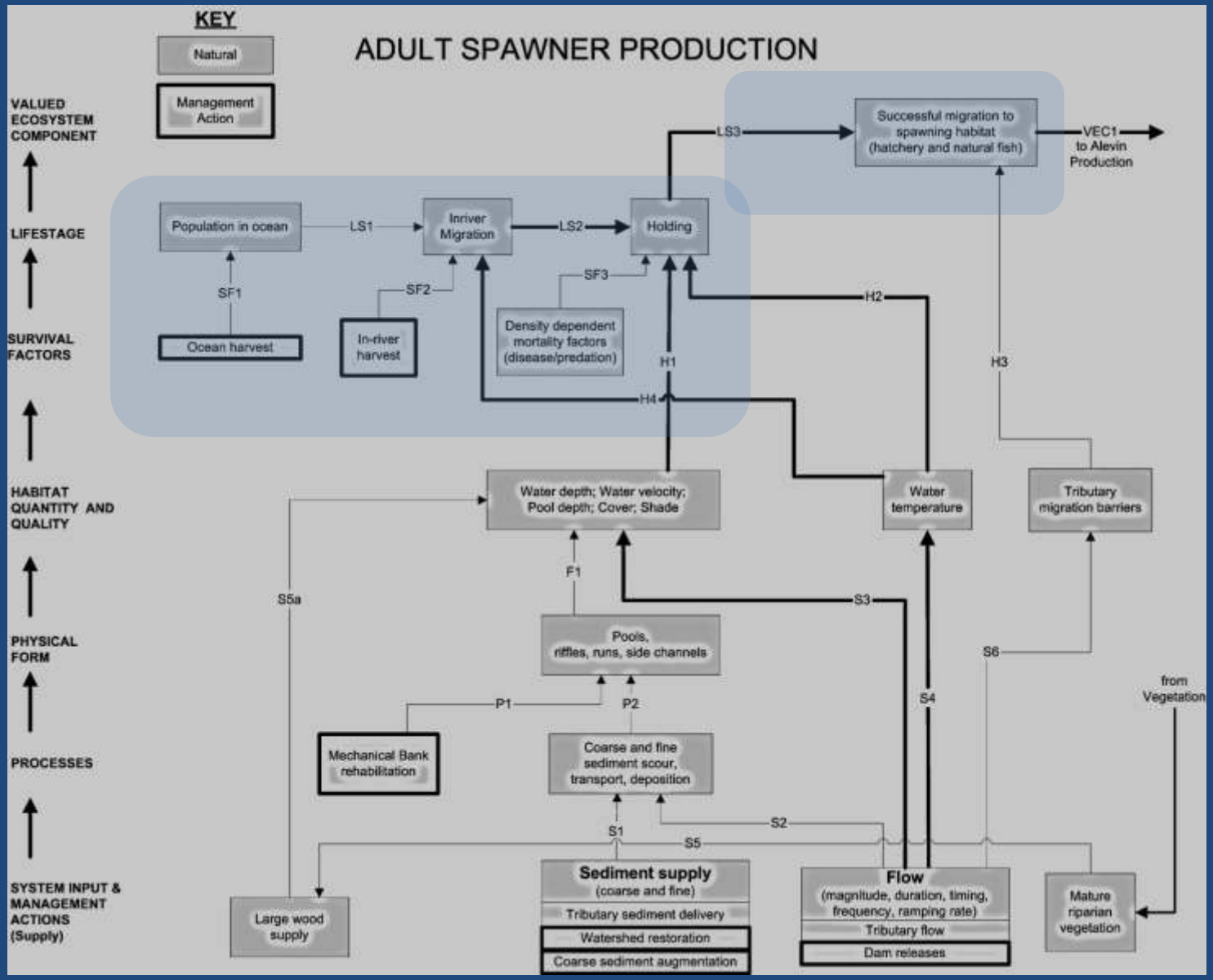


Levels of IAP objectives concerning TRRP adult monitoring and assessment activities.

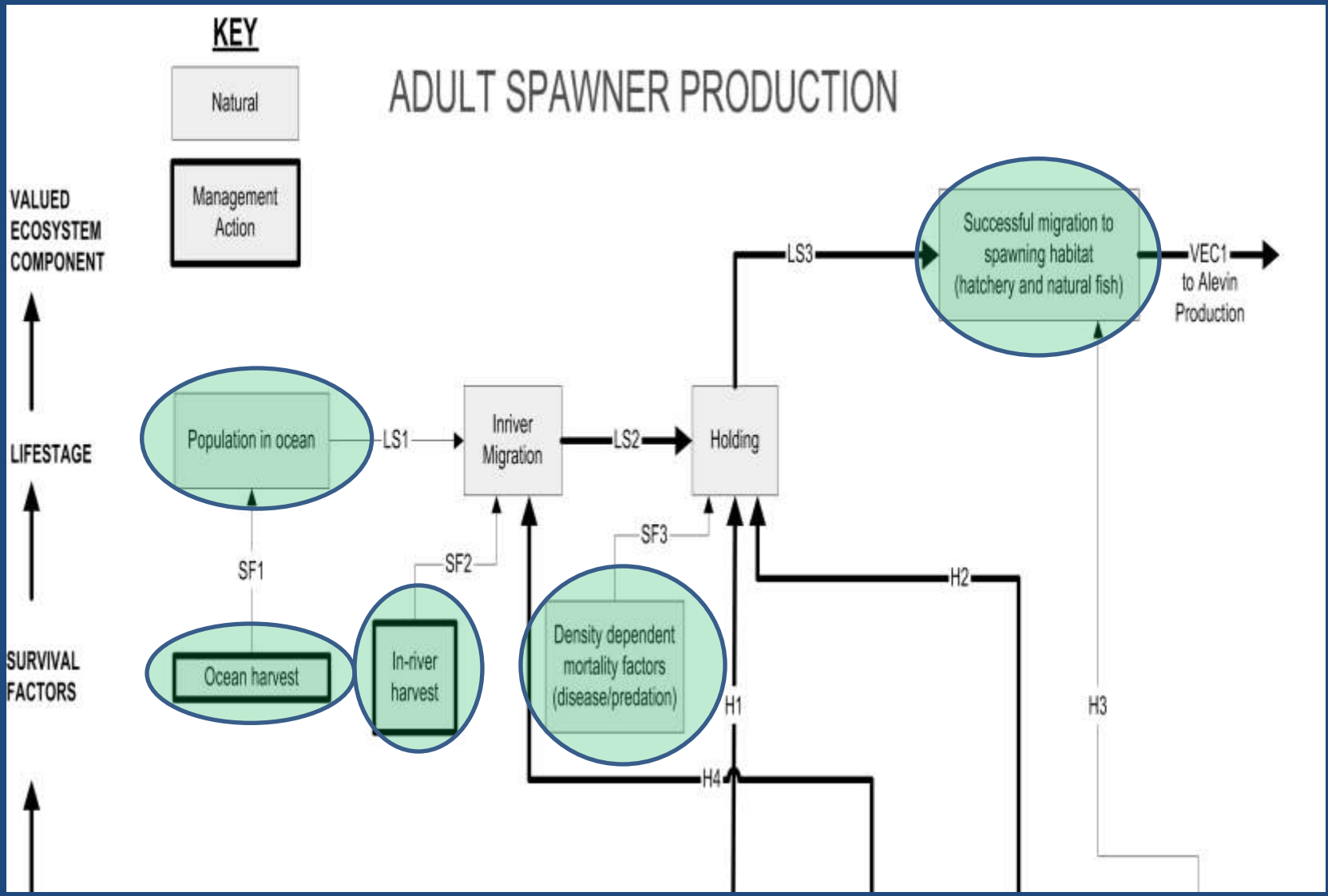
3. Restore and maintain natural production of anadromous fish populations #3. Habitat and biological influences	3.1 Increase spawning, incubation and emergence success of anadromous spawners	3.1.1 Optimize adult utilization of suitable spawning habitat areas in the mainstem within 3-4 brood cycles following rehabilitation of fluvial river processes
		3.1.3 Reduce temperature related pre-spawning mortality and protect in-vivo egg viability of anadromous spawners in the mainstem Trinity River
	3.3 Minimize impacts of predation, competition, and genetic interactions between and among hatchery and natural anadromous fish	3.3.2 Increase proportion of Natural Influence (pNI) to 0.7 or greater
4. Restore and sustain natural production of anadromous fish populations downstream of Lewiston Dam to pre-dam levels, to facilitate dependent tribal, commercial, and sport fisheries' full participation in the benefits of restoration via enhanced harvest opportunities #4. Harvest and Escapement Objectives	4.1 Increase naturally produced fall-run Chinook salmon adult production to the extent necessary to meet or exceed escapement objectives and facilitate expanded harvest opportunity	4.1.1 Increase escapement of naturally produced fall-run Chinook salmon to 62,000 adults
		4.1.2 Increase harvest of naturally produced fall-run Chinook salmon adults
	4.2 Increase naturally produced spring-run Chinook salmon adult production to the extent necessary to meet or exceed escapement objectives and facilitate expanded harvest opportunity	4.2.1 Increase escapement of naturally produced spring-run Chinook salmon to 6,000 adults
		4.2.2 Increase harvest of naturally produced spring-run Chinook salmon adults
	4.3 Increase naturally produced coho salmon adult production to the extent necessary to meet or exceed escapement objectives and facilitate expanded harvest opportunity	4.3.1 Increase escapement of naturally produced coho salmon to 1,400 adults
		4.3.2 Increase harvest of naturally produced coho adult salmon adults
	4.4 Increase naturally produced steelhead adult production to the extent necessary to meet or exceed escapement objectives and facilitate expanded harvest opportunity	4.4.1 Increase escapement of naturally produced steelhead to 40,000 adults
		4.4.2 Increase harvest of naturally produced steelhead adults
	4.5 Increase naturally produced Pacific lamprey adult production to the extent necessary to meet or exceed escapement objectives and facilitate expanded harvest opportunity	4.5.1 Increase escapement of Pacific lamprey adults
		4.5.2 Increase harvest of Pacific lamprey adults
	4.6 Increase naturally produced green sturgeon adult production to the extent necessary to meet or exceed escapement objectives and facilitate expanded harvest opportunity	4.6.1 Increase escapement of green sturgeon adults
		4.6.2 Increase harvest of green sturgeon adults

Conceptual diagram for adult production

from Conceptual Models document



Conceptual diagram for adult production –close-up.



Performance Measures and How They Relate to TRRP Goals and other Management Objectives.

Performance Measures Related to Program Goals of Spawning Escapement and Harvest

- ***Adult anadromous salmon spawner escapement for the Trinity Basin***, specifically:
  - ***62,000 naturally produced fall Chinook salmon;***
  - ***6,000 naturally produced spring Chinook salmon;***
  - ***40,000 naturally produced steelhead;*** *and*
  - ***1,400 naturally produced coho salmon.***

- ***Contribution of Trinity River naturally produced anadromous fish*** to dependent tribal, sport and commercial fisheries and recruitment.

Performance Measures and How They Relate to TRRP Goals and other Management Objectives.

Candidate Performance Measures

- ***Trinity specific number of age 3 ocean recruits*** of fall-run Chinook salmon.
- ***Brood-year specific recruits*** per spawner.
- ***Population growth rate*** (r).
- ***Percent of variation in the brood year performance*** attributable to in-river conditions and ocean conditions.
- ***Proportion of hatchery to natural adult anadromous fish.***

Other Adult Salmonid Performance Measures

- **Redd distribution and abundance**
- **Pre-spawning mortality**
- **Adult disease incidence and severity**

Technical Issues identified in the IAP

- Integration of age-structured harvest estimates and age-structured spawning escapement estimates may provide a complete assessment of the stock productivity of Trinity Basin naturally produced and hatchery produced fall Chinook. Can this be expanded to natural spring Chinook?

- Developing methods to estimate winter/spring steelhead run-sizes and age structure, and determining whether or not we can develop smolt/spawner indices.

- The validity of using Trinity specific cohort data to evaluate rehabilitation effects.

Policy Issues Identified in the IAP

- The TMC has chosen not to develop numeric harvest goals at this time. If this changes in the future, this issue would become a technical issue.

- While a coordinated harvest management plan exists for Klamath Basin (including Trinity) fall Chinook salmon, there is no Trinity specific harvest plan and the current plan for fall Chinook salmon does not recognize the Program's spawning escapement goals as a management target.

Work Shop

- Presentations of projects supported by the TRRP that support the adult salmonid assessments
- Presentations will address:
  - Project Objectives
  - How does the project support the Trinity River Restoration Program?
  - Field Methods
  - Analytical Methods
  - Project Reporting
  - Issues/Challenges/Feedback to TRRP

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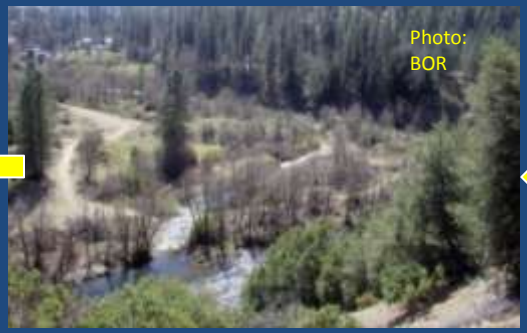
TRRP Restoration Strategy Conceptual Model for Fishery Resource Restoration



Adult Salmonid Run-size Estimation

CA Dept. of Fish and Game, Hoopa Valley Tribe

Wade Sinnen (CDFG)

Trinity River Restoration Program

Adult Monitoring Evaluation Workshop

October 26-27, 2011

Project Background

Trinity River basin estimates of spring and fall Chinook, coho and “fall-run” steelhead.

Project initiated in 1977-34 yr. dataset. Use of main stem weirs.

Mark-recapture methods used to estimate annual runs.

Angler harvest rates generated from return of reward tags.

Fall Chinook, steelhead and coho estimates upstream of Willow Creek (RM 22).

Spring Chinook estimates upstream of Junction City (RM 79).

Estimates include separation of hatchery-produced and naturally-produced components of each run.

Project Objectives

Assess progress toward meeting stated natural salmonid escapement goals.

Assess progress toward meeting stated goal of providing increased harvest opportunities for dependent tribal, sport and commercial fisheries.

Provide run characteristic data for assessing management actions (flow, temperature, hatchery operations).

Provide population metrics for dependent assessments (stock-recruit, smolts /spawner, cohort analyses, etc.)

How does this project support the Trinity River Restoration Program?

This project provides information relating to the overall success of the program (improved returns and harvest of naturally produced salmonids). Provides metrics for other disciplines.

The only stated biological numeric goal of the Program is to achieve naturally produced adult spawning escapements of 62,000 fall Chinook, 6,000 spring chinook, 1,400 coho and 40,000 steelhead. This project is designed to quantify escapement relating to these goals.

Field Methods

1. sampling methods/protocols

- Operate temporary weir structures for the purpose of sampling and marking a portion of returning salmonids.
- Tag (mark) fish with serially numbered floy spaghetti tags.
- A portion of tags are reward tags and are inscribed with our address.
- Recapture sample obtained at Trinity River Hatchery.
- Record species, fork length, marks, clips, tags and collect scales for age determination.

Adult Salmonid Run-size Estimation

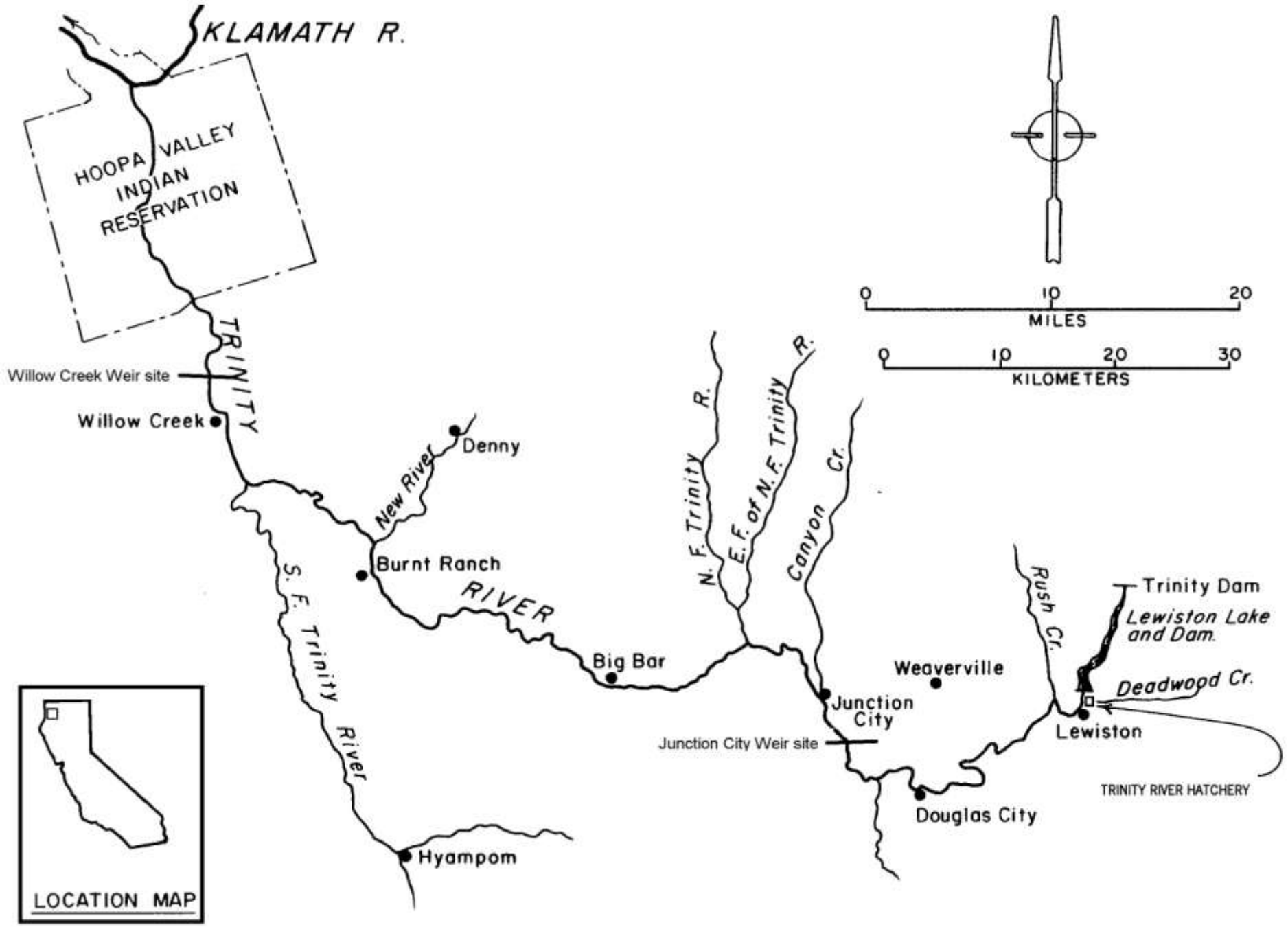
Field Methods

2. areas surveyed

- Basin estimates upstream of weir sites, hatchery direct count of all fish entering
- Spring Chinook upstream of Junction City.
- Fall chinook, coho and steelhead upstream of Willow Creek

3. sampling effort – time period and days/week

- Junction City –June through September
- Willow Creek – late August through November
- 5 sampling days a week at both sites, daily afternoon and weekend openings


KLAMATH R.
HOOPA VALLEY INDIAN RESERVATION
TRINITY
Willow Creek Weir site
Willow Creek
Denny
New River
Burnt Ranch
RIVER
S. F. Trinity River
Hyampom
Big Bar
N. F. Trinity R.
E. F. of N. F. Trinity R.
Canyon Cr.
Rush Cr.
Weaverville
Junction City
Junction City Weir site
Douglas City
Trinity Dam
Lewiston Lake and Dam.
Deadwood Cr.
Lewiston
TRINITY RIVER HATCHERY
0 10 20
MILES
0 10 20 30
KILOMETERS
LOCATION MAP

State of California -The Natural Resources Agency
DEPARTMENT OF FISH AND GAME
http://www.dfg.ca.gov

EDMUND G. BROWN, Jr. Governor
JOHN McCAMMAN, Director

Trinity River Project
5341 Ericson Way
Arcata, CA 95521
707/822-5876

Thank you for returning the tag you recovered in the Trinity River Basin.

We place tags on a portion of the returning adult salmon and steelhead to determine their respective run size, angler harvest and spawner escapement for the year. **Reward tags have "Reward" imprinted on them. Rewards will be paid whether tags were recovered by angling, found attached to dead fish or found loose/unattached.** You should receive your check approximately eight weeks from the date we receive this completed form. Non-reward tag information is important too, so thank you for sending those in as well. Please fill out information below:

NAME: _____

ADDRESS: _____

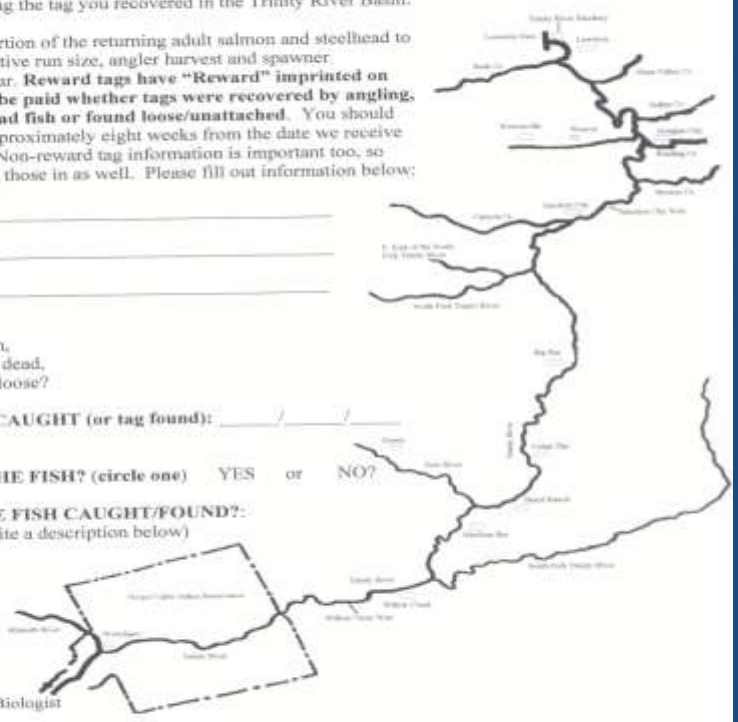
_____

CIRCLE ONE:
Did you catch the fish,
or was the fish found dead,
or was the tag found loose?

DATE FISH WAS CAUGHT (or tag found): ____/____/____

DID YOU KEEP THE FISH? (circle one) YES or NO?

WHERE WAS THE FISH CAUGHT/FOUND?:
(Mark the map or write a description below)



Thank you.
Mary Claire Kier
Trinity River Project Biologist
mckier@dfg.ca.gov

Conserving California's Wildlife Since 1870

Analytical Methods

1. Data management, QA/QC procedures
- Two sets of hard copy data sheets, all data edited twice.
- Recovery records verified against originals.
- Data maintained in database in three separate locations.

2. Data analyses (estimation methods)
   a. Point estimates generated using Peterson style Mark-recapture estimator, CI's estimated using Poisson or Normal approximations.
   b. Precision of estimates varies by year and species. Most precise is Fall Chinook (95% CI +/- 5 to 20%). Coho generally least precise (95% CI +/- 10 to 35%). Steelhead and spring chinook intermediate.

2010 WC Fall Chinook **FINAL 6/22/2011**

Minimum Adult size: 62
Willow Creek weir First week of run AT WCW 35
First week of run at TRH DJWeek 41

	Grilse	Adults	Total
Total trapped	401	902	1303
Morts in carcass	0	0	0
Tag morts	2	9	11
Not tagged	3	19	22
Dead in trap	0	0	0
Angler removed	0	4	4
Effective tags	396	870	1266

Point Estimates:

Stratified:		
Grilse	Adults	Total
12,324	28,126	40,450

Nonstratified: WC Gr/Ad %		
Grilse	Adults	Total
12,554	28,238	40,792

TRH Recovery			Est Total
Tagged	46	239	285
Total	1458	7749	9207
TRH grilse/adult %	15.836%	84.164%	
Weir grilse/adult %	30.775%	69.225%	
TRH and WCW %	17.7%	82.3%	

Total estimate

Poisson Approximation		% from point
Point Estimate	40,792	
95 CI min	36,427	10.70%
95 CI max	45,945	12.63%

Harvest :

Reward	Grilse	Adult
Tagged	121	300
Returned	1	2
% harvest	0.8264%	0.6667%
Nonreward		
Tagged	274	570
Returned	3	3
% harvest	1.095%	0.5%
Total		
Tagged	395	870
Returned	4	5
% harvest	1.013%	0.6%

Catch and release:

Reward	Grilse	Adult
Tagged	121	303
Returned	0	3
% harvest	0.00%	1.0%
Nonreward		
Tagged	274	571
Returned	0	1
% harvest	0.0%	0.175%
Total		
Tagged	395	874
Returned	0	4
% harvest	0.000%	0.458%

	Escapement			
Strata	TRH	Natural	Harvest	Run-size
	1,458	10,969	127	12,554
Adults	7,749	20,301	188	28,238
Total	9,207	31,270	315	40,792

Analytical Methods

c. Missing data, i.e. weir blowouts, loss of trapping days cause less precise estimates.

d. Attempt to trap and tag enough fish to produce 95% CI within 10% of point estimate.

3. Assumptions used in the analyses and support for their validity (i.e.: direct testing of assumptions or other evidence that supports the validity of the assumptions)

a. Capture probability at weirs equal for hatchery and wild fish and a random sample of the population. Hard to test, river recoveries of tags biased by decay, removal and lack of incomplete basin survey. Carcass survey results indicate lower tag recovery % than at hatchery.

Analytical Methods

b. Tagged and untagged fish are randomly mixed throughout the population and equally vulnerable to recapture at TRH. Hatchery recovery results indicate that largest return weeks also are largest tag recovery weeks (except spring Chinook).

C. All tags (program marks) are recognizable and tag loss estimated or accounted for. Tags are external and easily identified. Fish caught and released or recovered as tagging mortalities are excluded from the marked number.

Project Reporting

1. Reporting of information – in-season, preliminary reports, final reports

   In season weekly updates on trapping totals, quarterly progress reports, annual reports.

2. Data storage

   All data is stored in databases in several locations and on back-up drives.

Issues/Challenges/Feedback to TRRP

Explain any issues/challenges that have occurred and how these influence the ability of the project to meet its objectives.

- ROD flow (>1,000 cfs) releases have curtailed temporal efforts to estimate spring Chinook at Junction City weir. Estimates have lost precision.
- Winter flows prevent using weir methods for estimating winter steelhead runs.
- Spring/fall Chinook run-timing overlap may create bias in estimates (run-timing differentiated using hatchery fish as surrogate for both populations).
- Lack Trinity specific ocean harvest (naturals) prohibits full accounting for program.

Issues/Challenges/Feedback to TRRP

Present what we have learned from implementing this project (even preliminary analyses) in assessing the effectiveness of the TRRP.

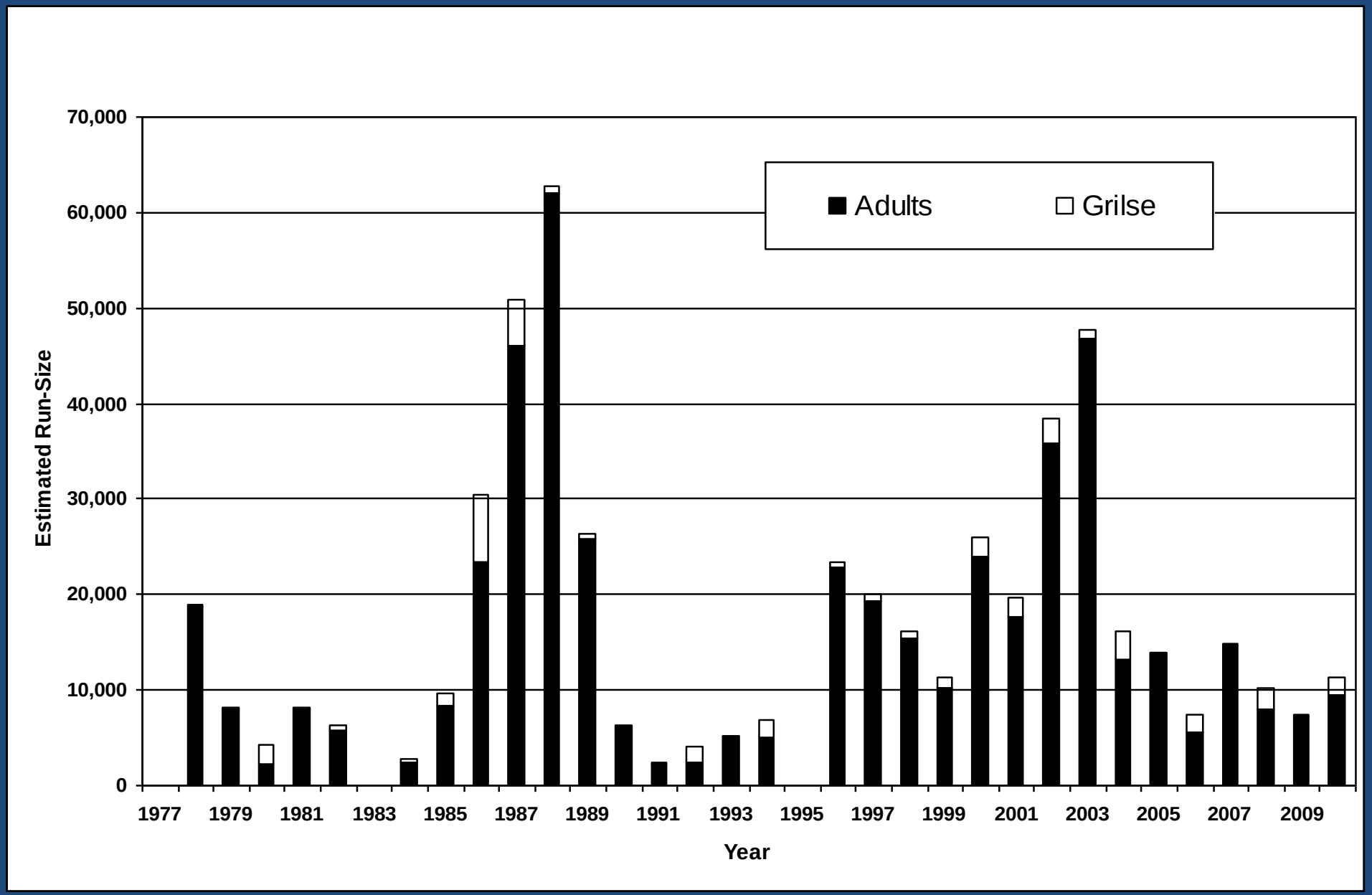
- Increasing trend in the proportion of wild fish in Chinook populations, coho and steelhead stable.
- Flows appear to influence adult migratory behavior.
- Populations still fluctuate in cyclical manner indicating ocean influence on survival.
- Survival of hatchery fish, particularly steelhead has benefited from the program.

Issues/Challenges/Feedback to TRRP

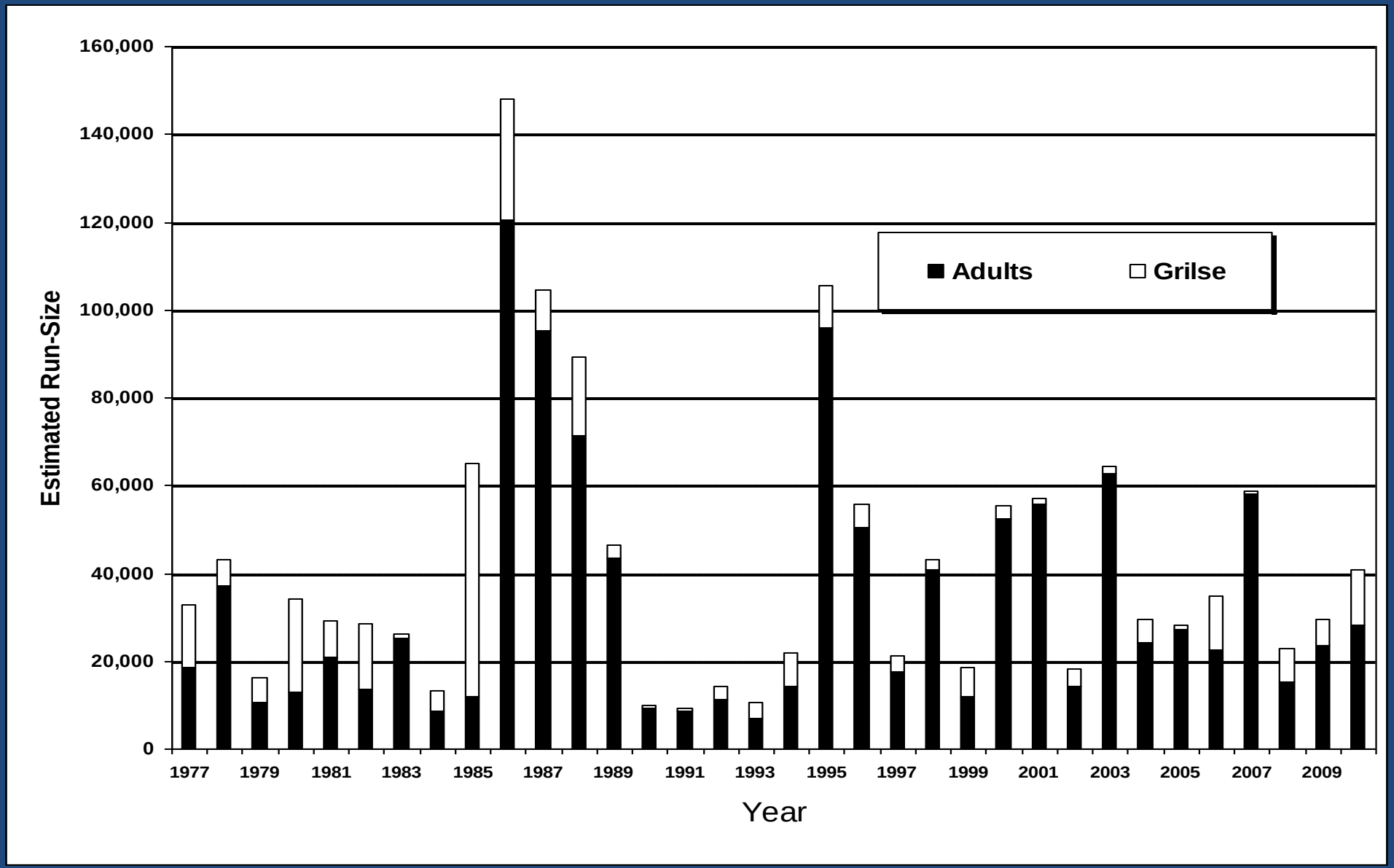
How does this information relate to evaluating and/or recommending management actions (linking back to information presented in slide #4)

- Need to evaluate current potential carrying capacity against Program goals and existing and projected habitat quantities.
- Need to evaluate hatchery production, lower Klamath River carrying capacity and disease issues, ocean productivity and harvest rates as potential bottlenecks.
- Need to reconcile TRRP production goals with contemporary management of Chinook salmon (2/3 harvest rate, min. floor escapement)

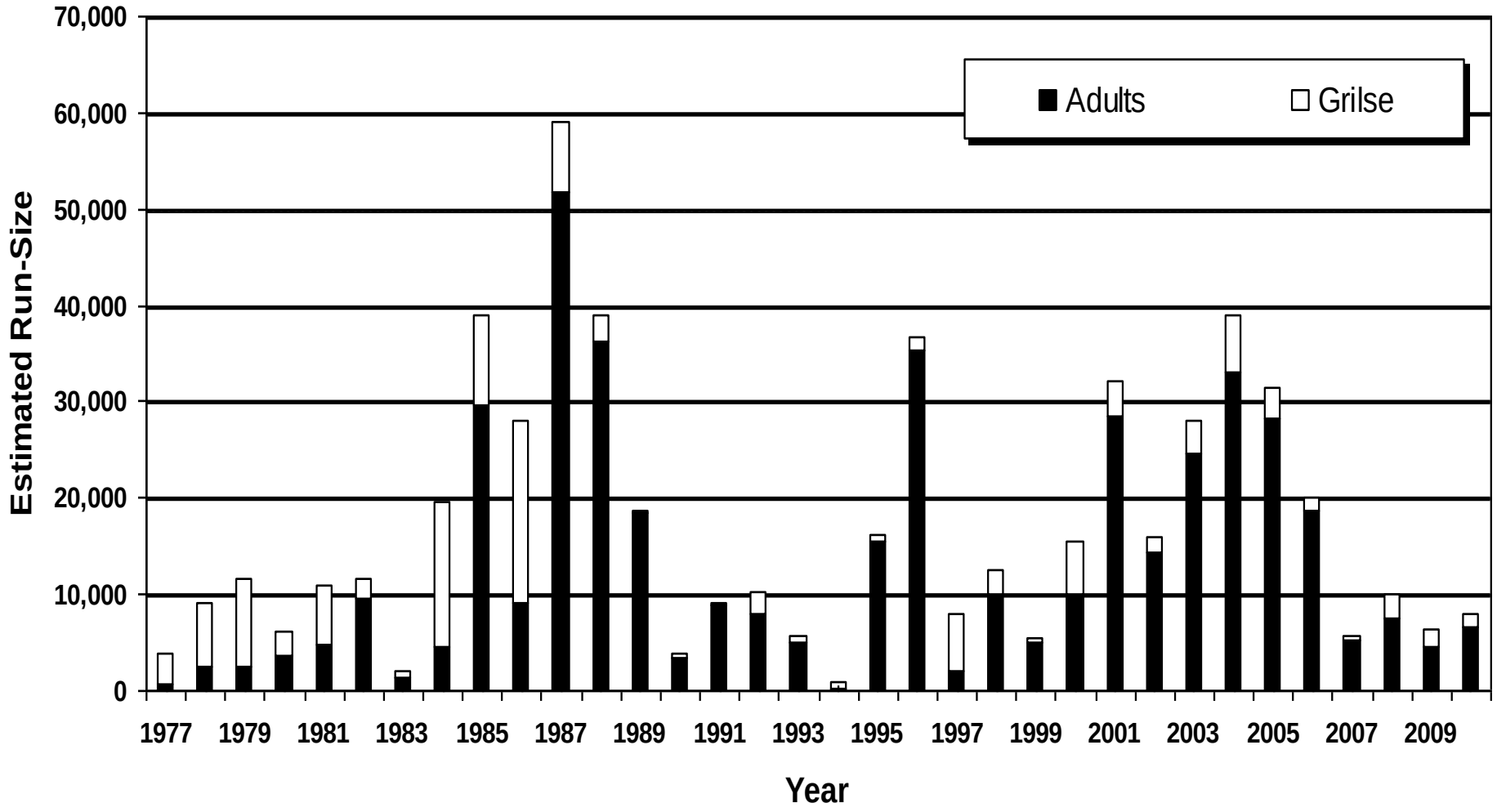
Spring Chinook run-size, 1977-2010



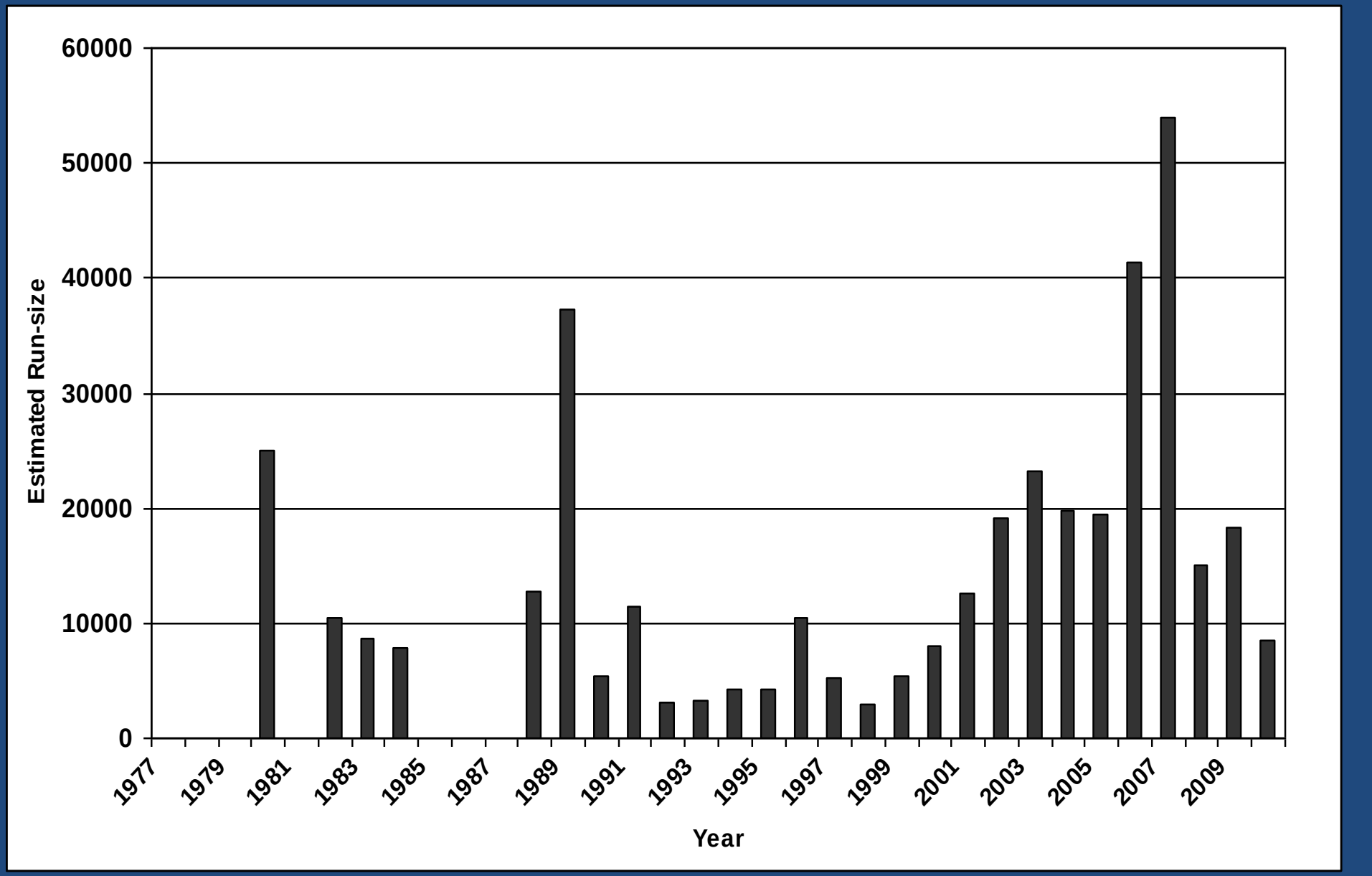
Fall Chinook run-size, 1977-2010



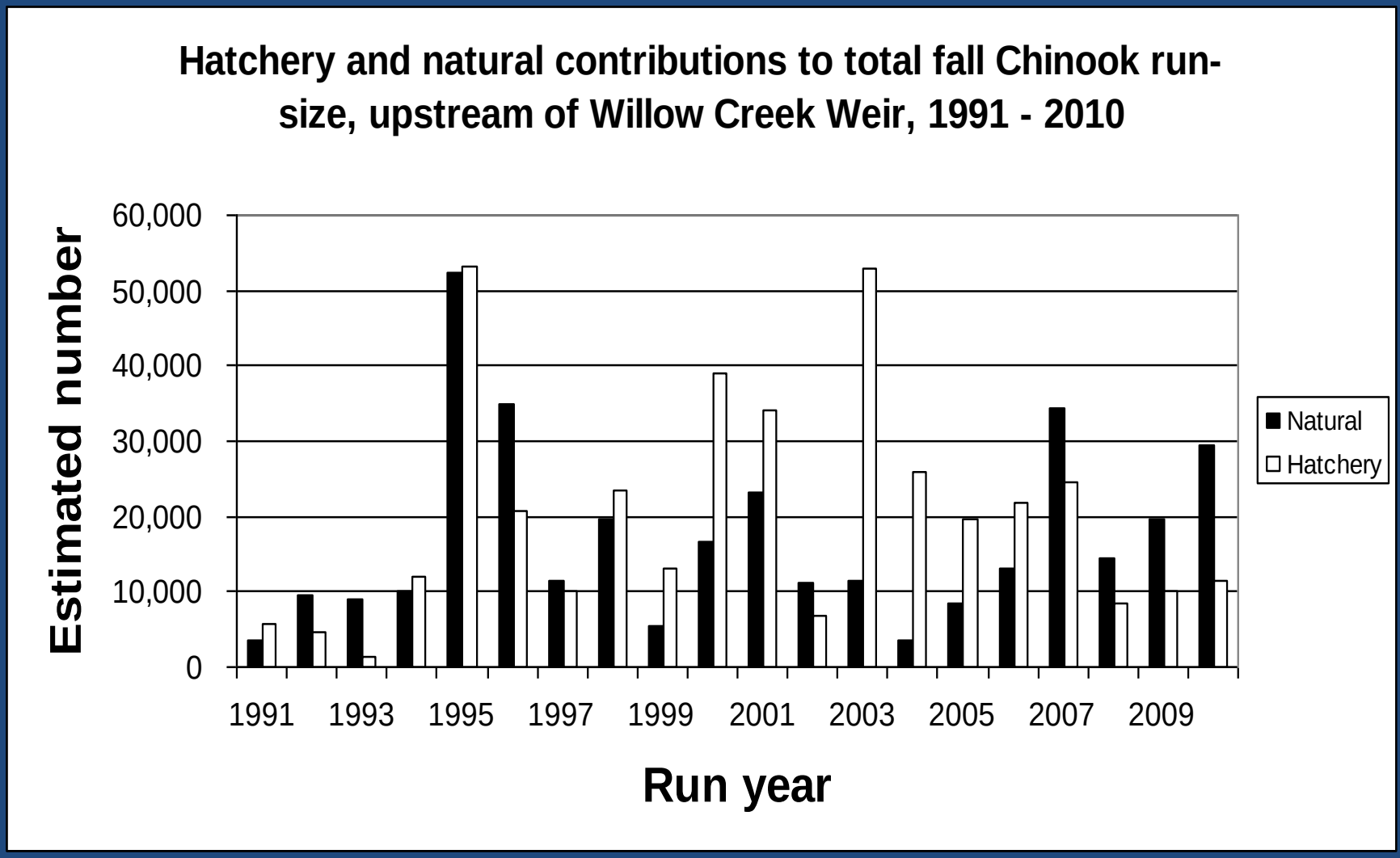
Coho salmon run-size, 1977-2010



Adult fall-run steelhead run-size, 1980-2010



Trinity River Restoration Program Adult chinook hatchery/natural metric



Hatchery mark and recovery programs

CA Dept. of Fish and Game, Hoopa Valley Tribe

Wade Sinnen (CDFG)

Trinity River Restoration Program

Adult Monitoring Evaluation Workshop

October 26-27, 2011

Project Background

•Marking of hatchery fish (spring and fall Chinook, coho and steelhead) has been on-going since the 1980's at Trinity River Hatchery.

• Prior to 1995 marking programs were not uniform and did not always occur.

• Recent marking programs (post 1995) have been consistent. Programs include 25% CFM (AD+CWT) for Chinook salmon and 100% fin clip for steelhead and coho.

• Current Chinook marking performed by the Hoopa Valley Tribe using auto trailer.

• Coho (DFG) and steelhead (HVT) marking performed manually. Coho receive right maxillary clip and steelhead receive adipose fin-clip.

• Marking program initially instituted to provide fishery data for ocean fishery management.

• Contemporary focus now includes estimation of in-river runs and decomposition into natural and hatchery components

Project Objectives

- Assess progress toward meeting stated natural salmonid escapement goals.

- Assess progress toward meeting stated goal of providing increased harvest opportunities for dependent tribal, sport and commercial fisheries.

- Provide population metrics for dependent assessments (stock-recruit, smolts /spawner, cohort analyses, survival estimates, etc.).

- Assess hatchery stray rates and temporal and spatial distribution of hatchery spawners.

How does this project support the Trinity River Restoration Program?

- This project provides information relating to the overall success of the program (improved returns and harvest of naturally produced salmonids).
- Provides assessment of hatchery survival rates, temporal and spatial migration patterns, incidence of disease. Hatchery fish are also used for screw trap efficiency studies.
- The only stated biological numeric goal of the Program is to achieve naturally produced adult spawning escapements of 62,000 fall Chinook, 6,000 spring chinook, 1,400 coho and 40,000 steelhead. This project is designed to help quantify escapement relating to these goals.

Field Methods

1. sampling methods/protocols

- Inventory and mark (AD+CWT) 25% of Trinity River Hatchery Chinook salmon production. Implant batch series coded-wire tags unique to species, brood year and release type.
- Inventory and mark 100% of Trinity River Hatchery coho salmon and steelhead.
- Recover and inspect all returning spawners at Trinity River Hatchery for marks/CWT's.
- Remove heads of AD marked salmon for CWT retrieval and decoding.
- Record proportion of hatchery marked fish at run and harvest sample sites/areas.

Field Methods

2. areas surveyed for recovery
- Basin estimates upstream of weir sites, hatchery direct count of all fish entering
- Sport and tribal fisheries, mainstem carcass surveys.

3. sampling effort – time period and days/week
- Junction City –June through September-spring Chinook
- Willow Creek – late August through November-fall Chinook, coho, steelhead
- 5 sampling days a week at both sites
- Stratified sampling in sport and tribal fisheries.

California Department of Fish and Game
Klamath River Basin Estimates

Basin estimates of hatchery and natural runs are made upstream of Willow Creek and Jjunction City weirs

Analytical Methods

1. Data management, QA/QC procedures

- Pre release sample from each hatchery raceway examined for clip quality/CWT retention.
- Fish loss records maintained by hatchery staff and incorporated into release reports.
- Data maintained in database in three separate locations, data is edited twice (DFG).
- CWT recoveries cross referenced to recovery site by head tag numbers.
- CWT data and release forms submitted to state tagging coordinator for upload to RMIS database.

Analytical Methods

2. Data analyses (estimation methods)

- Typically, hatchery contribution estimates are applied to run or harvest data which include sampling expansions for sampling effort and CWT expansions (Chinook).

- Hatchery contribution (steelhead & coho salmon) estimated by direct proportion observed in sample i.e. marked fish/total = hatchery proportion .

- Chinook salmon hatchery contribution estimated by producing AD+CWT run-size estimate. Data required includes CWT multiplier (@4), CWT Shed rate, overall CWT composition by release group and proportion of AD clipped salmon observed in sample.

Table 2. Run-size, angler harvest, and spawner escapement estimates for Trinity River Hatchery produced, coded-wire tagged, spring- and fall-run Chinook salmon returning to the Trinity River during the 2010-11season.

Run-size estimates	Run Size estimate		Harvest rates		TRH Ads With CWTs	% weir Ad clips		Ad+CWT Run-size estimates		
	Grilse	Adults	Grilse	Adults		Grilse	Adults	Grilse	Adults	Total
Sp. Chinook (JCW)	1,757	9,528	0.0%	4.8%	0.973	7.69%	10.64%	131.5	986.4	1,117.9
Fall Chinook (WCW)	12,554	28,238	1.0%	0.7%	0.960	4.76%	8.18%	573.9	2,218.0	2,791.9

CWT code	BY	Age	TRH Total No.	% of Total	Run-size	Angler harvest	Spawning escapement TRH	Natural	Total
Spring-run chinook salmon									
Adults									
065347	06	4	5.03	0.9%	9.4	0.4	5.0	3.9	8.9
065348	06	4	15.09	2.8%	28.1	1.3	15.1	11.7	26.7
065349	06	4	12.09	2.3%	22.5	1.1	12.1	9.3	21.4
065360	06	4	357.24	67.4%	664.6	31.6	357.2	275.8	633.0
068801	07	3	8.05	1.5%	15.0	0.7	8.1	6.2	14.3
068802	07	3	32.11	6.1%	59.7	2.8	32.1	24.8	56.9
068810	07	3	100.58	19.0%	187.1	8.9	100.6	77.6	178.2
		Totals:	530.19	1	986.4	47.0	530.2	409.3	939.4
Grilse									
068811	08		12.03	26.6%	34.9	0.0	12.0	22.9	34.9
068812	08		20.14	44.5%	58.5	0.0	20.1	38.4	58.5
068813	08		13.09	28.9%	38.0	0.0	13.1	24.9	38.0
		Totals:	45.26	1.00	131.5	0.0	45.3	86.2	131.5
Fall-run chinook salmon									
Adults									
065338	05	5	1.01	0.1%	1.3	0.0	1.0	0.3	1.3
065350	06	4	21.20	1.2%	26.7	0.2	21.2	5.3	26.5
065351	06	4	20.19	1.1%	25.4	0.2	20.2	5.1	25.3
065352	06	4	15.13	0.9%	19.1	0.1	15.1	3.8	18.9
065353	06	4	38.36	2.2%	48.3	0.3	38.4	9.7	48.0
065361	06	4	725.27	41.2%	914.1	6.1	725.3	182.8	908.1
068804	07	3	17.16	1.0%	21.6	0.1	17.2	4.3	21.5
068805	07	3	21.20	1.2%	26.7	0.2	21.2	5.3	26.5
068806	07	3	18.18	1.0%	22.9	0.2	18.2	4.6	22.8
068807	07	3	16.13	0.9%	20.3	0.1	16.1	4.1	20.2
068808	07	3	22.18	1.3%	28.0	0.2	22.2	5.6	27.8
068809	07	3	843.73	47.9%	1063.5	7.1	843.7	212.6	1056.4
		Totals:	1759.74	1.00	2218.02	14.79	1759.74	443.49	2203.23
Grilse									
065356	08	2	5.04	1.7%	9.7	0.1	5.0	4.5	9.6
065357	08	2	3.02	1.0%	5.8	0.1	3.0	2.7	5.7
065358	08	2	4.04	1.4%	7.8	0.1	4.0	3.6	7.7
065359	08	2	3.03	1.0%	5.8	0.1	3.0	2.7	5.8
068814	08	2	78.76	26.4%	151.3	1.5	78.8	71.0	149.8
068815	08	2	50.46	16.9%	97.0	1.0	50.5	45.5	96.0
068816	08	2	36.31	12.2%	69.8	0.7	36.3	32.7	69.1
068817	08	2	38.36	12.8%	73.7	0.7	38.4	34.6	73.0
068818	08	2	20.18	6.8%	38.8	0.4	20.2	18.2	38.4
068820	08	2	49.41	16.5%	94.9	1.0	49.4	44.6	94.0
0608080000	08	2	8.07	2.7%	15.5	0.2	8.1	7.3	15.3
0608080001	08	2	2.01	0.7%	3.9	0.0	2.0	1.8	3.8
		Totals:	298.69	1	573.9	5.8	298.7	269.4	568.1

Analytical Methods

3. Assumptions used in the analyses and support for their validity (i.e.: direct testing of assumptions or other evidence that supports the validity of the assumptions)

- Capture probability at sample sites equal for hatchery and wild fish and random sample of the population. No evidence to suggest this is not the case at weirs, fishery sample probably biased toward adult recoveries. Need to stratify collection data into grilse and adult components.

- All fin-clips (marks) are recognizable. Trained field personnel should have no problem, voluntary angler data i.e. catch and release may be suspect, particularly for coho salmon.

- Hatchery contribution rates and total estimate of hatchery or natural component of population subject to bias and precision of total estimates. Use corroborating evidence in analyses i.e. are mark rates in any particular year similar at sample sites. Example weir vs. net fishery.

Project Reporting - Dfg

1. Reporting of information – in-season, preliminary reports, final reports

   In season weekly updates on trapping totals, quarterly progress reports, annual reports.

2. Data storage

   All data is stored in databases in several locations and on back-up drives.

Issues/Challenges/Feedback to TRRP

Explain any issues/challenges that have occurred and how these influence the ability of the project to meet its objectives.

- ROD flow (>1,000 cfs) releases have curtailed temporal efforts to estimate spring Chinook at Junction City weir. Estimates have lost precision. Could be biased if differential run-timing between hatchery and natural fish.
- Winter flows prevent using weir methods for estimating winter steelhead runs.
- Spring/fall Chinook run-timing overlap may create bias in estimates (run-timing differentiated using hatchery fish as surrogate for both populations).
- Lack of Trinity specific ocean and lower Klamath River harvest prohibits full accounting for program.

Issues/Challenges/Feedback to TRRP

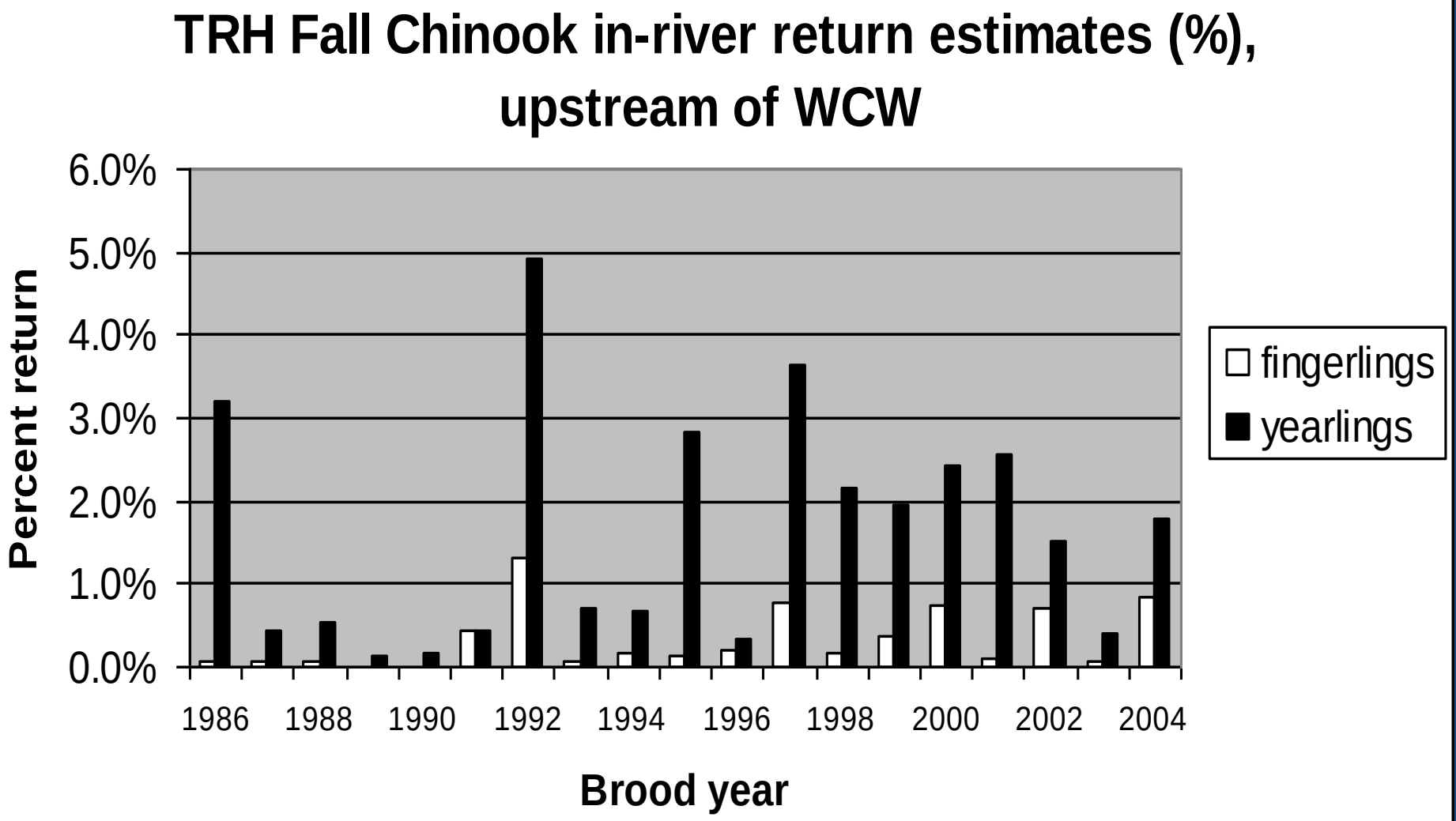
Present what we have learned from implementing this project (even preliminary analyses) in assessing the effectiveness of the TRRP.

- Increasing trend in the proportion of wild fish in Chinook populations, coho and steelhead stable.
- Flows appear to influence adult migratory behavoir.
- Populations still fluctuate in cyclical manner indicating ocean productivety or factors influence survival.
- Survival of hatchery fish, particularly steelhead has benefitted from the program.
- Hatchery fish stray rates can be significant, although appear to be related to distance from hatchery.

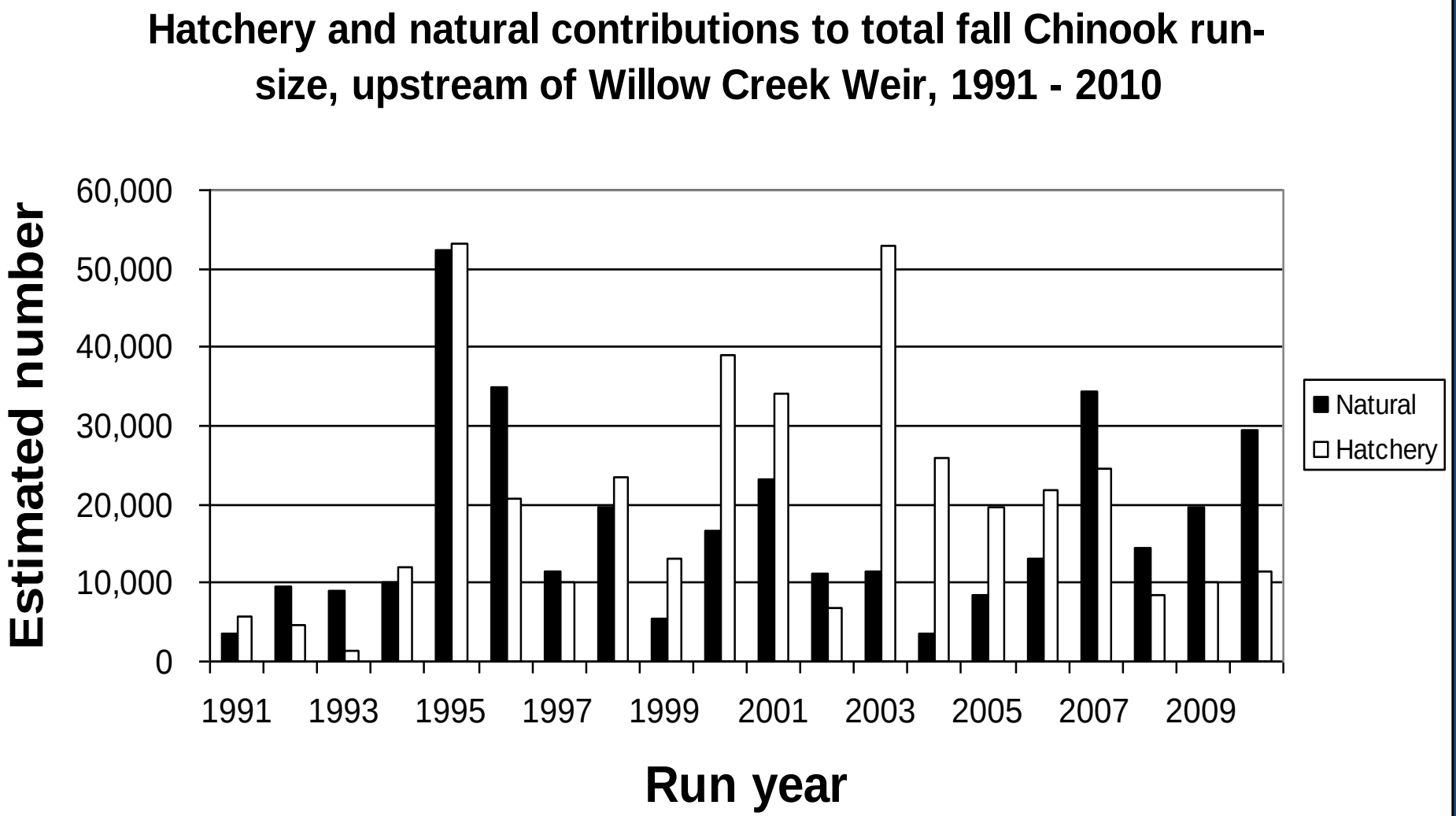
Issues/Challenges/Feedback to TRRP

How does this information relate to evaluating and/or recommending management actions (linking back to information presented in slide #4)

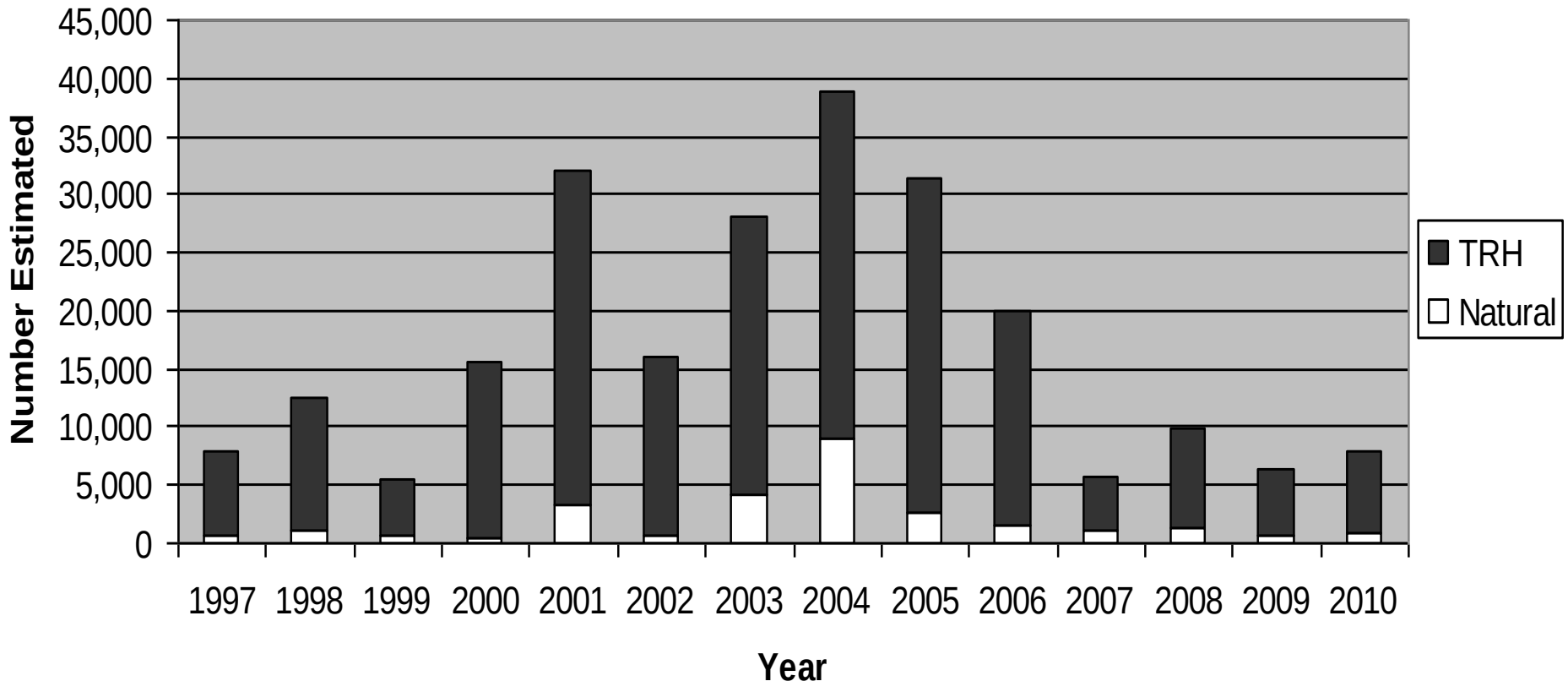
- Currently not meeting steelhead and fall Chinook natural escapement goals.
- Need to evaluate current potential carrying capacity against Program goals and existing and projected habitat quantities.
- Need to evaluate hatchery production, lower Klamath River carrying capacity and disease issues, ocean productivity and harvest rates as potential bottlenecks to natural production.
- Need to reconcile TRRP production goals with contemporary management of Chinook salmon (2/3 harvest rate, min. floor escapement)


TRH Fall Chinook in-river return estimates (%), upstream of WCW
Percent return
6.0%
5.0%
4.0%
3.0%
2.0%
1.0%
0.0%
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
Brood year
fingerlings
yearlings

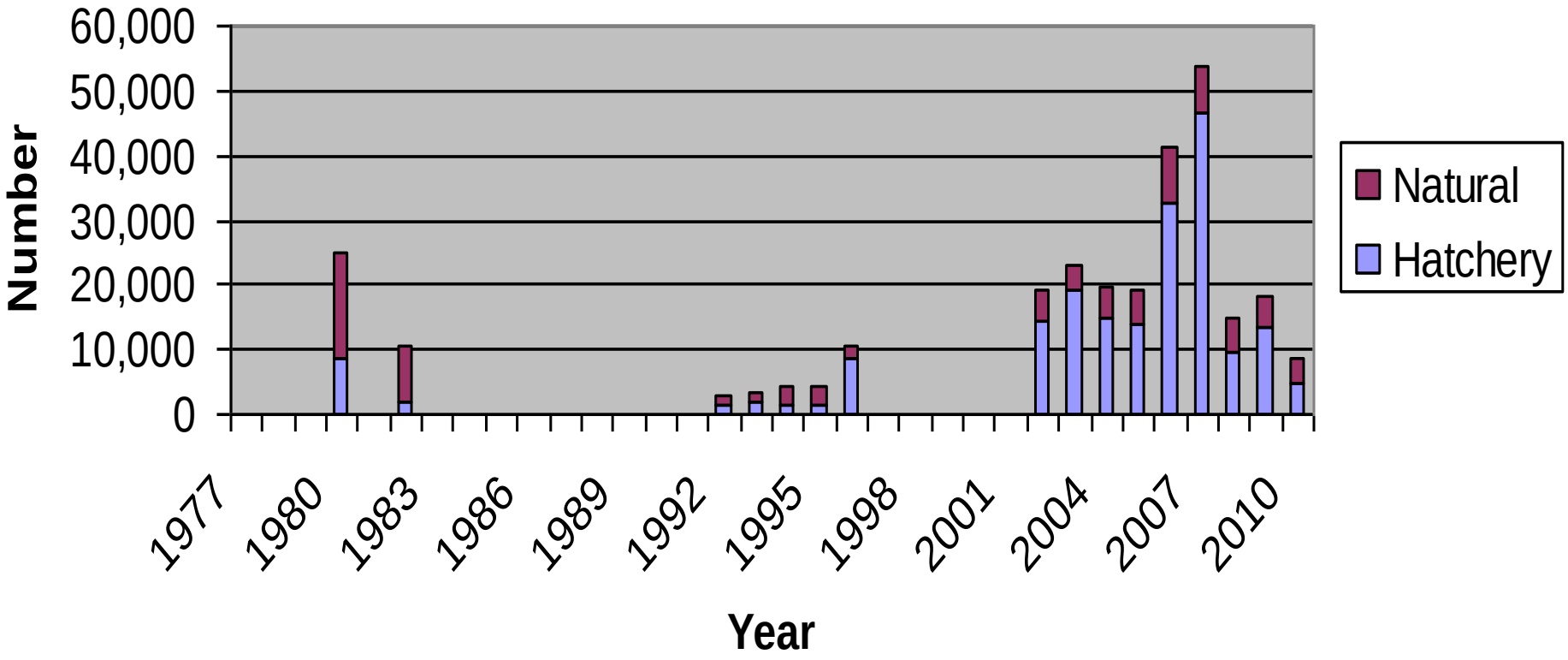
Hatchery mark and recovery programs



Hatchery mark and recovery programs



Naturally- and Hatchery- produced Fall Steelhead Run-size Estimates



Recreational Harvest on Lower Trinity

Hoopa Valley Tribe

George Kautsky/ Eric Logan

Trinity River Restoration Program

Adult Monitoring Evaluation Workshop

October 26-27, 2011

Recreational Harvest on Lower Trinity
Project Title

Project Background

- **Overall objective:** Estimate total angler harvest of fall Chinook and Steelhead between WCW downstream to confluence with Klamath River.
  - –HVTFD has implemented a roving creel census in lower Trinity River since 1992
  - –Geographic Scope has varied but methods remained similar through the years

Project Objectives

- **IAP Objective 4:** Restore numbers of naturally produced salmon and steelhead to pre-TRD population levels in the Trinity River in order to facilitate dependent tribal, commercial, and sport fisheries full participation in the benefits of restoration via enhanced harvest opportunities
  - Project is a portion of the total run assessment generated annually for Trinity naturally produced salmonids
    - Assessment 17A Monitor harvest (tribal, sport and commercial) of naturally produced fall Chinook
    - Assessment 19A Monitor harvest (tribal, sport and commercial) of naturally produced steelhead)
    - Assessment 18A Monitor harvest (tribal, sport and commercial) of naturally produced coho
    -

How does this project support the Trinity River Restoration Program?

- Monitoring the harvest by the Recreational Fishery contributes to the overall assessment of TRRP's accomplishment in meeting its goal for restoring natural adult fish contributions to dependent fisheries at capacities commensurate with pre-TRD levels.

Recreational Harvest on Lower Trinity

Field Methods

- **sampling methods/protocols**
  - Roving Creel Census
  - Total effort estimated by vehicle and angler count, average angler per vehicle assigned to non-interviewed vehicles.
  - Average hours complete effort estimated from angler interviews/voluntary report cards
  - Total harvest within sample day estimated by total effort * average hours fished for completed effort by angler * average catch per hour of effort

- **areas surveyed**
  - from Willow Creek Weir, downstream to Klamath confluence
  - Drift boats interviewed at take out points (e.g. Tish Tang Beach, Weitchpec Beach), or by voluntary census card

- **sampling effort – time period and days/week**
  - Seasonal Sampling starting in late August continuing through November, as fishery and flows dictate.
  - Time Stratified: Two “Weekend Days of Three (Friday, Saturday, or Sunday); one Weekday of four, selected at random in each Julian Week.

Analytical Methods

1. Data management, QA/QC procedures
   - DBase programs were developed for data archival and reduction functions
   - Plans for sample design are supervised and executed consistent with program needs
     - Samplers are trained and then performance monitored to ensure optimal coverage of fishing effort
   - Relational data base and consistent practices ensure control, protection, delivery of data and information assets
     - Data recorded on paper forms which are templates from DBase data reduction application
     - Data are entered into DBase for analysis by reduction programs

1. Data analyses (estimation methods)
   a. Estimators used…. Continuing

Analytical Methods/ Estimators used

- **Vehicle Anglers**
-
- A_v = Estimated total anglers in vehicles (*tribal and non-tribal*)
- V_t = All vehicles counted
- $A_{v.e}$ = Anglers enumerated in vehicles
- $V_{a.e}$ = vehicles with anglers enumerated
-

$$A_v = V_T * \frac{A_{v.e}}{V_{a.e}}$$

- **Proportion of Non-Tribal Anglers**
-
- P_{nt} = Proportion non-tribal anglers
- A_{nt} = Non-tribal anglers interviewed
- A_t = Tribal anglers interviewed
-

$$P_{nt} = \frac{A_{nt}}{(A_{nt} + A_t)}$$

Analytical Methods/ Estimators used (continued…)

- **Proportion of Non-Tribal Anglers on Foot**
-
- $P_{nt.f}$ = Proportion of non-tribal anglers-on-foot
- A_{nt} = Non-tribal anglers interviewed
- $A_{nt.f}$ = Non-tribal anglers-on-foot interviewed

$$P_{nt.f} = \frac{A_{nt.f}}{A_{nt}}$$

- **Correction Factor to Add Anglers-On-Foot to Anglers in Vehicles**
-
- $C_{nt.f}$ = Correction factor to include non-tribal anglers on foot (not in vehicles)

$$C_{nt.f} = \frac{A_{nt}}{(A_{nt} - A_{nt.f})} = \frac{1}{(1 - P_{nt.f})}$$

Analytical Methods/ Estimators used (continued…)

- **<u>Stratum Day Expansion Factor</u>**
- Sampling sub-strata within Julian Weeks:
- Monday, Tuesday, Wednesday, and Thursday; four ‘weekdays’.
- Friday, Saturday, and Sunday, three ‘weekend days’.
- (If only one stratum is sampled, the entire week is treated as a stratum of 7 days.)
-
- D_t = Total days in stratum
- D_s = Sampled days in stratum

E_s = Stratum expansion factor =

$$\frac{D_t}{D_s}$$

Analytical Methods/Estimators used (continued…)

- **Estimated Total Non-tribal Anglers in Stratum**
-
- A_{nt} = Estimated total non-tribal anglers in stratum =
- (Anglers in vehicles) * (Proportion non-tribal anglers) * (Factor to include on-foot anglers) * (Stratum day expansion factor)
-

$$\hat{A}_{nt} = (V_T * \frac{A_{v.e}}{V_{a.e}}) * (\frac{A_{nt}}{(A_{nt} + A_t)}) * (\frac{A_{nt}}{(A_{nt} - A_{nt.f})}) * (\frac{D_t}{D_s})$$

Recreational Harvest on Lower Trinity

Analytical Methods/Estimators used (continued…)

- **Hours Fished per Day per Angler**
- $A_{nt.d}$ = Non-tribal (interviewed) anglers done for day
- $H_{nt.d}$ = Hours fished by non-tribal anglers done for day
- A_{nt} = All (interviewed) non-tribal anglers
- H_{nt} = Hours fished by all non-tribal anglers for day
-

Average hours fished per day by non-tribal anglers *done* fishing =
(Hours fished by non-tribal anglers done for day) / (Non-tribal anglers done for day)

$$\overline{H}_{nt.d} = \frac{H_{nt.d}}{A_{nt.d}}$$

Average hours fished per day by all non-tribal anglers =
(Hours fished by all non-tribal anglers interviewed) / (Non-tribal anglers interviewed)

$$\overline{H}_{nt} = \frac{H_{nt}}{A_{nt}}$$

Average hours fished per day =
Maximum of average fishing hours for anglers done fishing and all anglers

$$\overline{H}_{nt} = Max(\overline{H}_{nt.d}, \overline{H}_{nt})$$

Analytical Methods/Estimators used (continued…)

Fish Catch per Hour

Average catch of species ‘s’ per hour by non-tribal anglers =

(Total of species ‘s’ caught by non-tribal anglers) / (Total hours fished by non-tribal anglers)

$$\overline{C}_{nt.s} = \frac{\sum C_{nt.s}}{\sum H_{nt}}$$

Estimated Total Catch of Species ‘s’ in Stratum

Stratum estimated total catch of species ‘s’ =

(Total anglers) * (Hours fished per day per angler)*(Average catch of species ‘s’ per hour)

$$\hat{C}_{nt.s} = \hat{A}_{nt} * \overline{H}_{nt} * \overline{C}_{nt.s}$$

Analytical Methods

a. Precision of estimates: No Variance estimate developed.

b. How are missing data issues are addressed:

Inability to interview all anglers for completed effort within a randomly selected sample day. Results from completed angler interviews are expanded to estimate total hours effort and expected catch per angler hour.

Uncooperative anglers occasionally do not participate in interviews. This is addressed by recording that unit of effort and projecting estimated catch/angler hour on that unit

c. Power analyses conducted to determine sample size:

No power analysis has been conducted. There is no specific hypotheses being tested with this project, so power analyses seem inappropriate.

Budget constraints set limitation on sampling to two weekend stratum days & one weekday stratum day.

Evaluation of historic data revealed that effort levels vary with weekday/weekend day strata therefore stratified random model implemented to minimize uncertainty in total estimate, though uncertainty (S.D. is not explicitly calculable).

Analytical Methods

d. Assumptions used in the analyses and support for their validity (i.e.: direct testing of assumptions or other evidence that supports the validity of the assumptions).

Voluntary report cards are distributed to anglers who are not directly contacted by sampler. Assume that these report cards are reliable surrogates for an interviewed angler. Report card provides supplemental information, the majority of angler effort is **interviewed** within a stratum.

Project Reporting

1. Reporting of information – in-season, preliminary reports, final reports
   - In season estimates of weekly total harvest reported to state co-manager for Chinook quota management
   - Final report submitted 6 months after close of field work (approximately April-May of following calendar year).

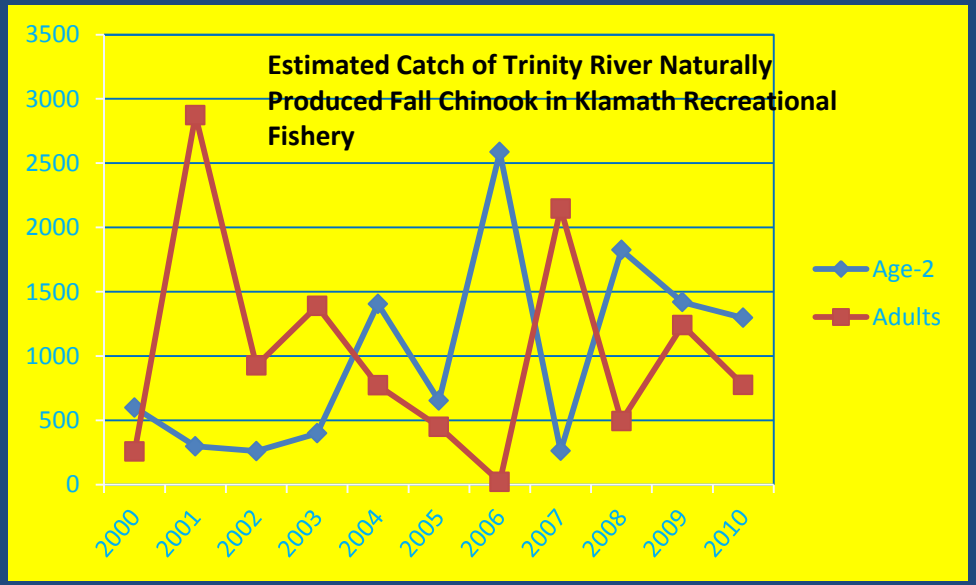
2. Data storage
   - Data are stored in DBase Tables.

Issues/Challenges/Feedback to TRRP

1. Explain any issues/challenges that have occurred and how these influence the ability of the project to meet its objectives.
    - Harvest estimates of recreational fishery in Trinity River provide estimates of Trinity origin fish caught. The Companion project in lower Klamath fails to directly estimate contribution of Trinity River Natural Origin fish to the combined estimates of rec. harvest.
    - This census relies upon voluntary sharing of catch details by anglers
    - Determination of anglers/vehicle introduces error of estimation, and possibly bias to overall catch estimate.

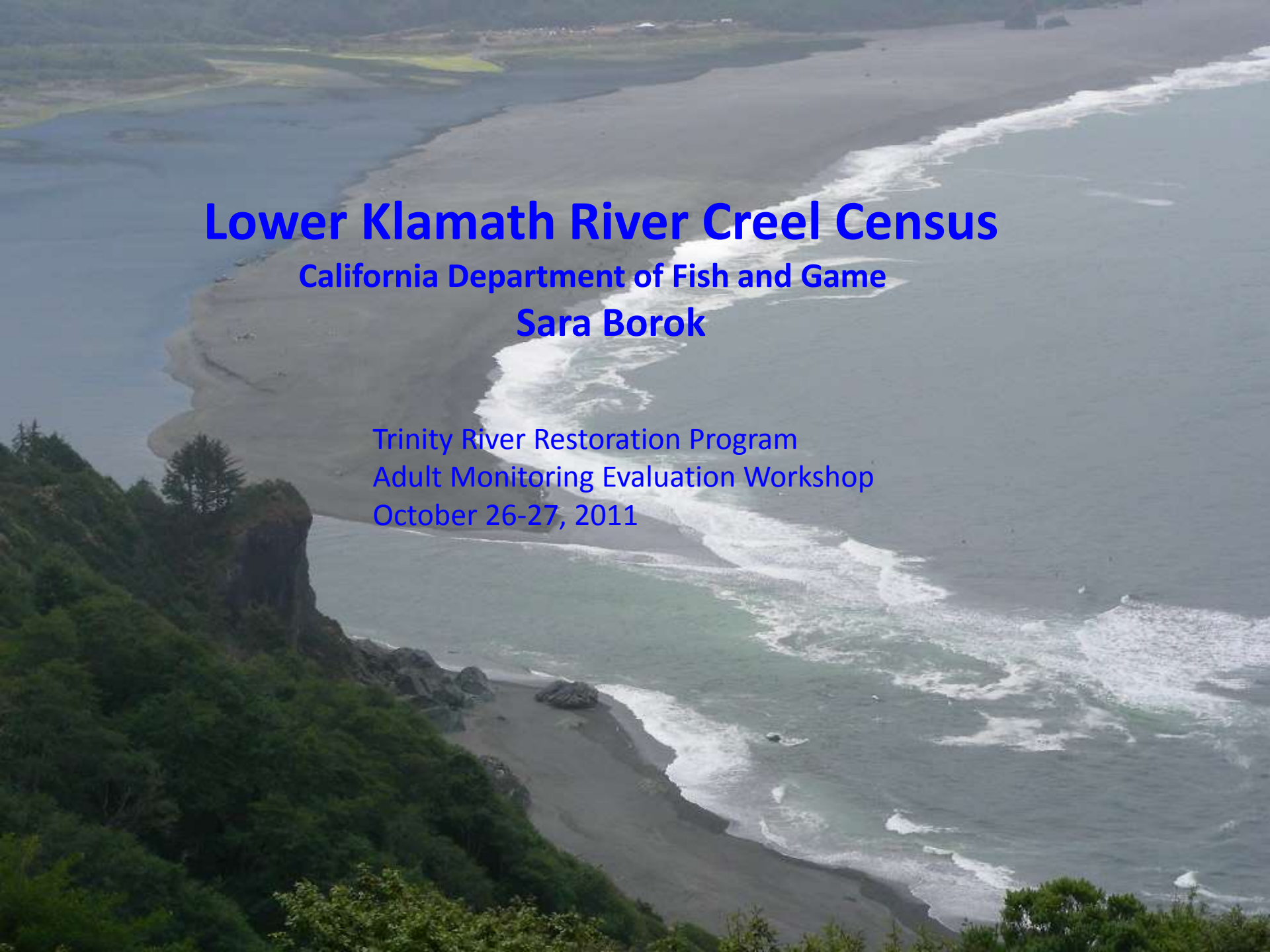
Issues/Challenges/Feedback to TRRP (Continued…)

2. Present what we have learned from implementing this project (even preliminary analyses) in assessing the effectiveness of the TRRP.



Issues/Challenges/Feedback to TRRP (Continued…)

3. How does this information relate to evaluating and/or recommending management actions (linking back to information presented in slide #4)
   - Monitoring harvest by the Recreational Fishery contributes to the overall assessment of TRRP's accomplishment in meeting its goal for restoring natural adult fish contributions to dependent fisheries at capacities commensurate with pre-TRD levels.
   - Progress toward achieving pre-TRD populations of fish is assessed at numerous life history stages. No single assessment will fully evaluate success of the TRRP or reveal new management prescriptions. The syntheses of these assessments becomes the body of knowledge required to guide management actions.



Lower Klamath River Creel Census

California Department of Fish and Game

Sara Borok

Trinity River Restoration Program
Adult Monitoring Evaluation Workshop
October 26-27, 2011

Project Background

The Lower Klamath River Creel Census Survey has been conducted in this manner since 1978. It was started and continues to be the primary source of real time sport harvest data for fall-run Chinook Salmon. In addition to the sport harvest data, this survey collects data for seasonal summaries and comparisons of angler effort and catch, catch timing, length frequencies, species composition, hatchery fin clips and tag recoveries on fish entering the Klamath System.

Project Objectives

- Quantify angler effort, catch per effort and total catch (harvest or catch and release).
- Determine the hatchery component of harvest (Iron Gate and Trinity River Hatchery).
- Monitor progress toward program goals.
- Collect scales samples from fall Chinook for age structure determination.
- Collect biological information i.e FL data, sex, fin-clips, signs of disease, marks, predator scars, etc. Quota and stock assessment management for fall Chinook.

How does this project support the Trinity River Restoration Program?

• Assessments relating to this project are:

• 12F9, 12F18, 12F24, and 12F25 Progress towards goals, Monitor harvest (tribal, sport and commercial) of naturally produced fall Chinook.

•

• PITAS to address:

•

•Integration of age structured harvest estimates and age structured spawning escapement estimates to get cohort estimates for fall Chinook? (Most robust data set).

•The current PFMC and DFG harvest management plans for fall Chinook salmon do not recognize the Program's spawning escapement goals as a management target (Klamath Basin is managed as one group, with 30-40% harvest rate).

•This project is an integral part of Klamath Basin Management for fall Chinook salmon as it provides age structured harvest estimates for Klamath Basin management and assessment.

Field Methods

Sampling methods/protocols:

- Access Point and Roving Creel Census
  - Complete coverage (full fishing day@ 14 hours) at each access point.
  - Rove to get total effort in Estuary to expand sampled Access points.

Interview anglers on completed trips for effort and, demographics. When Harvest occurs all fish are measured (when possible), sexed, checked for hatchery clips, scales are taken and other pertinent data is recorded. The number of released fish is also recorded as part of interview

KRP CREEL SURVEY
CALIFORNIA DEPARTMENT OF FISH AND GAME

PAGE 1 OF 1

LOCATION: T-RAMP DATE: 8/6/02 RECORDER: S. Borok

ANGLER NO.	ZIP CODE	MODE	FISHING HRS	SPP	H/M	FORK LENGTH	SEX	FIN CLIP & HEAD TAG NUMBER	COMMENTS
001	95503	3	20	1	Y	64	F		
		3		2	Y	73	M	2 Ad 55507	15
002	94603	3	35						
003	94103	3	65						
004	95303	3	40	1	Y	32	U	2 5 Ad RV	
		3		2	Y	53	U	2 Ad-55208	7
		3		1	Y	36	F		
		3		1	Y	34	U		
005	95963	1	15	2	Y	61	F		
006	92303	3	25	1	Y	52	M	2 Ad	6 Ck Pins #16171
		3		1	N	000			3 ½ lb
		3		2	N	999			3 Adult
		1		2	Y	76	M		2
007	95303	1	45	2	Y	50	M		
		1		2	Y	61	M	2 Ad 55209	17
		1		2	N	999		2 Ad 55210	
008	NRR		—	2	N	000		2 Ad 55211	
	NRR		—	2	N	999			3 x4
009	95503	3	40	2	N	999			3 x10 SA
010	95503	1	40	1	N	000			3 x5
011	95503	1	40	2	N	000			

ZIPCODE = FIRST THREE NUMBERS ONLY; MODE = 1-SHORE-COMPLETE EFFORT, 3-BOAT COMPLETE EFFORT.
SPECIES(SPP)= 1=STEELHEAD; 2=KING SALMON; 3=COHO SALMON; 6=CUTTHROAT; 8=STURGEON; "X"=OTHER(specify)
HARVEST MARK (HM) = "Y" or "N".
FORK LENGTH = ENTER "000" FOR GRILSE CATCH & RELEASE OR "999" FOR ADULT CATCH & RELEASE.
SEX = "M" IF MALE, "F" IF FEMALE, "U" IF UNKNOWN.
FIN CLIP = 1=DORSAL(D), 2=ADIPOSE(AD), 3=ANAL(AN), 4=LEFT VENTRAL(LV), 5=RIGHT VENTRAL(RV)
6=LEFT PECTORAL(LP), 7=RIGHT PECTORAL(RP), 8=LEFT MAXILLARY(LM), 9=RIGHT MAXILLARY(RM);
(Note: ENTER THE FIN CLIP ABBREVIATIONS ON THE DATA SHEET.)
COMMENTS = 1=GILL NET MARKS, 2=HOOKING SCAR(OCEAN), 3=CATCH & RELEASE, 4=WOUND, CAUSE UNKNOWN,
5=PREDATOR SCAR, 6=ANY TAG RECOVERY, 7=PARASITES, (e.g., SEA LICE.)
(Note: ENTER ONLY THE NUMBER CODE ON THE DATA SHEET.)

DAILY HARVEST SUMMARY:

	SH	KS	CATCH & RELEASE TOTAL SH	CATCH & RELEASE TOTAL KS
ADULTS	2	4	0	6
GRILSE	3	2	11	2

Field Methods

Areas Surveyed:

The ocean to the HWY 101 Bridge is Area 1.

The HWY 101 Bridge to the HWY 96 Bridge in Weitchepec is Area 2.

With in Area 1:

Three resort boat docks (Panther Creek RV, Riverside RV and Golden Bear RV) and the south side of the Mouth are the access points sampled.

With In Area 2:

The public boat ramp (Roy Rook near Terwer Creek), beach access at Klamath Glen and Blakes Riffle beach access are the sample locations.

Field Methods

Sampling effort – time period and days/week

Fall Surveys Start August 6 and run until November 4th of each season.

Each Area is sampled 3 days per Julian week (two week days and 1 weekend day).

On each day sampled a technician is on site till all effort at that site is done for the day.

Sun	*Mon*	*Tue*	*Wed*	*Thu*	*Fri*	*Sat*
				1 Area 1 M –CW P- BD RV-GS GB- MK	**2** Area 2 R- EW/ MG G- RP B- CM	**3** Area 1 M –CW P- BD RV-GS GB- MK **AREA 2 too!!**
4 Area 2 R- EW/ MG G- RP B- CM **AREA 1 Too!!**	**5** Labor Day	**6** Area 2 R- EW/ MG G- RP B- CM	**7** Area 1 M –CW P- BD RV-GS GB- MK	**8** Area 2 R- EW/ MG G- RP B- CM	**9**	**10** Area 2 R- EW/ MG G- RP B- CM
11 Area 1 M –CW P- BD RV-GS GB- MK	**12** Area 2 R- EW/ MG G- RP B- CM	**13** Area 1 M –CW P- BD RV-GS GB- MK	**14** Area 2 R- EW/ MG G- RP B- CM	**15** Area 1 M –CW P- BD RV-GS GB- MK	**16**	**17** Area 1 M –CW P- BD RV-GS GB- MK
18 Area 2 R- EW/ MG G- RP B- CM	**19** Area 1 M –CW P- BD RV-GS GB- MK	**20** Area 2 R- EW/ MG G- RP B- CM	**21** Area 1 M –CW P- BD RV-GS GB- MK	**22** Area 2 R- EW/ MG G- RP B- CM	**23**	**24** Area 2 R- EW/ MG G- RP B- CM
25 Area 1 M –CW P- BD RV-GS GB- MK	**26** Area 2 R- EW/ MG G- RP B- CM	**27** Area 1 M –CW P- BD RV-GS GB- MK	**28** Area 2 R- EW/ MG G- RP B- CM	**29** Area 1 M –CW P- BD RV-GS GB- MK	**30**	

Analytical Methods

Data management, QA/QC procedures

Interviews are recorded on data sheets in the field. We have experimented with hand held devices, but the technology is not where it needs to be at this point in time for this kind of survey.

All data are checked for errors and then is entered into both Dbase and Access files. Data is edited . Summaries and estimates are generated from completed data.

- **Analytical Methods**

1. Data analyses (estimation methods)
   a. Estimators used

$$\text{Estimate total} = \sum_{I=1}^{n} \text{Daily total } (N/n)$$

where: Estimate total = estimates of catch or effort

Daily total = Daily counts of catch or effort

N = Number of fishing days in week

n = number of sample days

I = boat sampling ratio

Lower Klamath Creel

Actual Harvest - area 1

Julian week	Modes	Angler Trips	Hours	Steelhead Grisle	Steelhead Adults	<56 Chinook Grisle	>55 Chinook Adults	Coho Grisle	Coho Adults	
32	Shore	25	57.5	0	0	0	0	0		
	Boat	54	107.5	0	0	0	0	0		
33	Shore	18	43.5	0	0	0	2	0		
	Boat	83	189.5	0	0	0	5	0		
34	Shore	50	152	0	0	0	1	0		
	Boat	164	476	0	1	2	14	0		
35	Shore	56	159.5	0	0	0	1	0		
	Boat	98	332.5	0	0	6	5	0		
36	Shore	59	200	0	0	0	3	0		
	Boat	71	259	0	0	2	7	0		
37	Shore	39	101	0	0	0	6	0		
	Boat	103	363.5	0	0	7	28	0		
38	Shore	13	42	0	0	0	1	0		
	Boat	47	185	0	0	5	16	0		
39	Shore	9	27	0	0	0	0	0		
	Boat	45	148	0	0	1	17	0		
40	Shore	21	55	0	0	0	1	0		
	Boat	5	28	0	0	0	2	0		
41	Shore	10	21.5	0	0	0	0	0		
	Boat	7	36	0	0	0	0	0		
42	Shore	9	26	0	0	0	0	0		
	Boat	2	10	0	0	0	0	0		
43	Shore	1	1	0	0	0	0	0		
	Boat	0	0	0	0	0	0	0		
44	Shore	1	1	0	0	0	0	0		
	Boat	0	0	0	0	0	0	0		
Totals										
	Shore	311	886	0	0	0	15	0	0	
	Boat	679	2134.5	0	1	23	94	0	0	
	Total	990	3020.5	0	1	23	109	0	0	
							132			

Expansion Values for Area1

Julian week	BEF	DEF
32	1.67	2.33
33	1.67	2.33
34	1.77	2.33
35	1.87	2.33
36	1.87	2.33
37	2.14	2.33
38	2.32	3.5
39	2.9	1.75
40	4	3.5
41	4	2.33
42	4	3.5
43	1	1.75
44	1	3.5

- **Analytical Methods**

  Precision of estimates (provide examples of previous data if available)

  Confidence intervals are not done at this time but can be added to future surveys.

- **Analytical Methods**

  How are missing data issues addressed

  Missing data is addressed on a case by case basis.

  For example if a site is not sampled for one day during the week, that site can be expanded for two days instead of three days.

- **Analytical Methods**

  Assumptions:

  Sampling day selected is equal to any day not selected (the bite could be on or off).

  Anglers at sampled sites harvest at the same rate as un-sampled sites.

Project Reporting

Reporting of information – in-season, preliminary reports, final reports

Weekly summaries are made public during the season. Quota information is recorded at 1-(800)564-6479 as well during the fishing season.

Quarterly Reports and Final Reports are available.

Data storage

Hard copies of data sheets are kept at the Arcata CDFG Office and computer files are kept in multiple locations.

Issues/Challenges/Feedback to TRRP

Explain any issues/challenges that have occurred and how these influence the ability of the project to meet its objectives.

Funding at this time is inadequate. The funding has remained the same (or less) since the BOR started funding this task in 1998.

Funding level only accommodates fall Chinook sampling, tail end of coho and steelhead runs are not sampled.

How does this information relate to evaluating and/or recommending management actions (linking back to information presented in slide #4).

This project provides age structured harvest estimates, hatchery composition of harvest and quota management.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Yurok Tribal Fall Fisheries Monitoring

Yurok Tribe

Desma Williams/Dave Hillemeier

Trinity River Restoration Program

Adult Monitoring Evaluation Workshop

October 26-27, 2011

Project Background

- The U.S. Fish and Wildlife Service (USFWS) began monitoring the Tribal fishery in 1978.
- The USFWS monitored the fishery through 1993, with assistance from the Yurok Tribal Fisheries Program (YTFP) from 1992 to1993.
- The Yurok Tribe assumed full responsibility for monitoring the fishery in 1994.

Project Objectives

- Estimate harvest of all species in the Yurok Tribal fall fishery (August through November).
  - Provide harvest numbers to the “Mega-table” for harvest management and other purposes (such as cohort reconstruction).
- Collect coded wire tags (CWT) from the Tribal fishery and calculate appropriate sampling expansions for the recovery of these tags.
  - Provides information for hatchery/natural determination as well cohort reconstruction.
- Collect scales and biological information from a sample of harvested fish.
  - Scales used by age composition project which feeds into cohort reconstruction

How does this project support the Trinity River Restoration Program?

- Collects information from the Yurok Tribal fall fishery to assess the harvest of Klamath/Trinity fish stocks by the Yurok Tribe during the fall fishery.
  - –Provides information necessary for cohort reconstruction of Trinity River stocks; hatchery and natural origin.
    - •Cohort reconstruction can be used to determine pre-harvest abundance of Trinity River broods - Useful for assessing the effect of various parameters upon Trinity chinook abundance.
- Enables responsible harvest management and assessment of Program goals
  - –Per amendments to 1984 Act and 1995 act, and as noted in the ROD, “fishery restoration would be measured not only by returning anadromous fish spawners, but also by the ability of dependent tribal and non-tribal fishers to participate fully in the benefits of restoration whether fisheries are able to “participate fully in the benefits of restoration through meaningful harvest opportunities”.

Sampling Methods

Effort

- Daily (Mid and Up-Klamath areas) – Two to three net runs are made each day, and nets seen are noted on a map. These notations are counted at the end of the day to determine total nets fished.
- Hourly (Estuary from August 1 – Sept 30) – Net runs are made on the odd numbered hours from 7 a.m. through 1 a.m. and the counts noted. These counts are summed and doubled to get net hours per shift.

Catch per Effort

- Daily – Fishers are contacted after each net run, and interviewed to determine how many nets they used and how many fish they caught. All nets sampled are combined to estimate an average catch per effort for the day.
- Hourly – Fishers are contacted as often as possible between net runs (and at buying station during commercial fisheries) and interviewed to determine how long they've been fishing, how many nets they used, and how many fish were caught in that time period. These data are used to estimate the catch per effort for each shift.

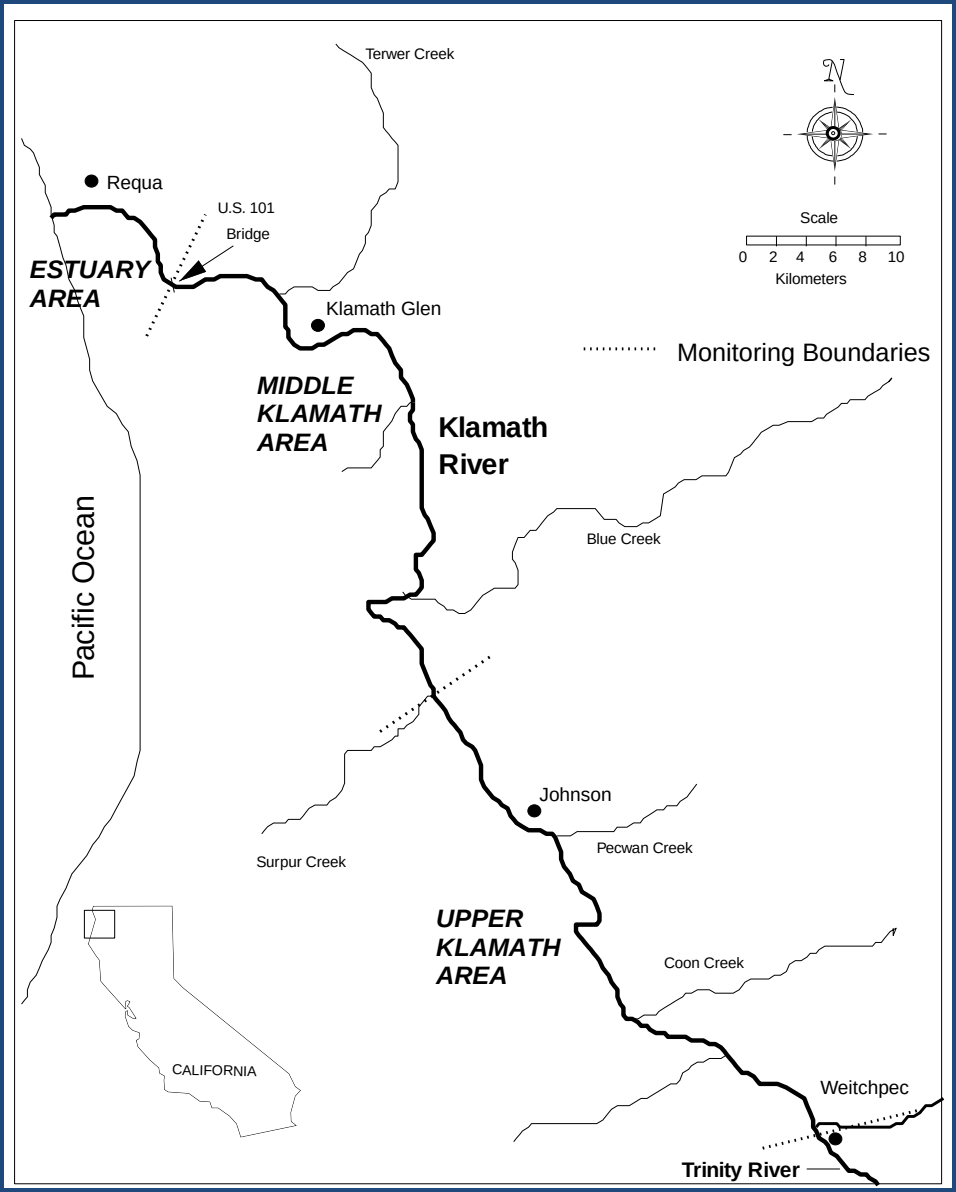
Biological Data

- Fishery monitors biosample as many fish as possible within the time available, taking scales, measurements, snouts from ad-clipped fish, weights from ungutted fish, and noting predator injuries.

Areas Surveyed

The entire Yurok Reservation is monitored and is divided into three management areas.

- Estuary (Area 1) – Mouth of river to Highway 101 bridge
- Middle Klamath (Area 2) – Highway 101 bridge to Surpur Creek
- Upper Klamath (Area 3) – Surpur Creek to upper end of Reservation (approximately one mile upstream of Trinity confluence)



Sampling Effort

Estuary hourly monitoring – Monitored every day net fishing is open. Monitored from 7:00 a.m. through 1:00 a.m., or until fishing is closed for the night, whichever is earlier.

Upper areas daily monitoring – Monitoring is done mostly in the evenings when drift net fishing is most common and in the mornings when fishers check their nets. Typically monitor every day net fishing is allowed.

Estuary late season daily monitoring – Monitoring effort mirrors fishing effort and changes with the tides.

Data Management, QA/QC

Data sheets are examined at the end of each day for inconsistencies and errors, and corrected as necessary.

Data is entered into dBase tables. Harvest is estimated daily using a dBase program. Separate programs are used to estimate the Estuary and upper areas because of the different methodologies. The estimates are initially output into a dBase file with a single line for each area and date, with the estimated effort for each net type and harvest estimates for each net type and species maintained separately.

Data is also entered into a secondary dBase file, and the contents of the secondary file are compared to the primary file with a dBase program. Discrepancies are listed by the comparison program, and the entry errors are corrected to match the actual data sheets.

Data Analyses

Estimators used - Harvest

Effort * Catch/Effort = Catch

Effort estimated from net counts

- Daily from net positions noted on net map
- Hourly from bihourly net counts multiplied by two

C/E estimated from interviews with fishers

- Seen contact – Ask fisher how many nets or nets and hours fished and monitor makes physical count of fish
- Unseen contact - Ask fisher how many nets or nets and hours fished and ask how many fish of each species they caught: reliable fishers only
- C/E averaged from all contacts for period of estimate

Data Analyses

Estimators used - CWT Expansion

CWTs collected are summarized by week

Expanded for sampling by week

- Sample Ratio = Total Estimate/fish examined
- Head Recovered Ratio = ad-clips seen/heads recovered
- Lost Tag Ratio = heads with tags/ tags decoded

Sampling expansion factor = Sample Ratio*Head Recovered Ratio * Lost Tag Ratio

Production Multiplier applied to total sampling expanded CWTs

Data Analyses

Estimators used – Spring vs. Fall Chinook

The proportion of spring chinook is estimated for each of the first three weeks of the season, and the result subtracted from the total estimate that week to yield fall chinook harvested.

To estimate the proportion of spring Chinook, the spring and fall CWTs recovered in the Yurok fishery are expanded and summed by week to give total hatchery spring chinook and total hatchery fall chinook harvested.

These sums are multiplied by expansion factors based on a five year average of total basin escapement divided by total basin hatchery chinook, for both spring and fall chinook. The results are used to estimate the proportion of spring vs. fall chinook for that week.

Yurok Tribal Fisheries Monitoring

Data Analyses

Estimators used – Basin Specific Hatchery vs. Natural Fish Harvested

K_e = Estimated escapement to the Klamath Basin above the Trinity confluence

T_e = Estimated escapement to the Trinity Basin

K_{cwt} = Estimated fish from coded wire tag lots of Iron Gate Hatchery origin returning to the Klamath basin

T_{cwt} = Estimated fish from coded wire tag lots of Trinity River Hatchery origin returning to the Trinity basin

Y_{cwtk} = fish from IGH coded wire tag lots (i.e. CWTs expanded) recovered in the Yurok fishery

Y_{cwtt} = fish from TRH code wire tag lots (i.e. CWT's expanded) recovered in the Yurok fishery

Y_H = Estimated Yurok harvest

Y_{TN} = Trinity natural fish harvested in the Yurok fishery

Y_{TT} = Yurok harvest to total Trinity fish

$$Y_{TT} = \frac{(T_e/T_{cwt} * Y_{cwtt})}{(T_e/T_{cwt} * Y_{cwtt}) + (K_e/K_{cwt} * Y_{cwtk})} * Y_H$$

$$Y_{TN} = Y_{TT} - Y_{cwtt}$$

Yurok Tribal Fisheries Monitoring

Data Analyses

Precision of estimates

Definitions and notations for all equations presented herein are summarized as follows:

- a = Number of fishing days available in time period.
- s = Number of days sampled in time period.
- y = Number of nets sampled during a sample day.
- Y = Daily number of nets fished.
- $\hat{Y}_i$ = Estimated net hours (Estuary Area) by day/night period on the ith day.
- C_i = Catch per net for the ith day.
- $\bar{C}_i$ = Mean catch per net or mean hourly catch (Estuary) for the ith day.
- $\hat{C}_i$ = Estimated total catch for the ith day.
- $\hat{C}_p$ = Estimated total catch for the pth period.
- $\bar{C}_p$ = Mean estimated catch across sample days for the pth period.
- $\hat{V}(C_i)$ = Variance of daily catch on the ith day.
- $\hat{V}(\hat{C}_p)$ = Variance of catch across sample days for the pth period.
- $\hat{V}(\hat{Y}_i)$ = Variance of net hours on the ith day (Estuary Area).
- $V(\bar{C}_i)$ = Variance of mean hourly catch on the ith day (Estuary Area)

The variance associated with the Estuary harvest estimate were calculated by using the following formula (Goodman 1960): equation (3a),

$$\hat{V}(\hat{C}_i)=(\bar{C}_i)^2[\hat{V}(\hat{Y}_i)]+(\hat{Y}_i)^2[V(\bar{C}_i)]-[\hat{V}(\hat{Y}_i)][V(\bar{C}_i)]$$

The variance associated with daily harvest estimates in the Middle Klamath and Upper Klamath areas were calculated using the following formula (Cochran 1977): equation (3b),

$$\hat{V}(\hat{C}_i)=\frac{(Y-y)}{y}V(\bar{C}_i)Y^2$$

The variance associated with the catch estimate for a time period were calculated using the following formula (Cochran 1977): equation (4),

$$\hat{V}(\hat{C}_p)=\frac{a(a-s)\Sigma(\hat{C}_i-\bar{C}_i)^2}{s(a-1)}+\frac{a\Sigma[\hat{V}(\hat{C}_i)]}{s}$$

95% confidence interval for harvest estimates were calculated using the following formula: equation (5),

$$95\%\ CI=\hat{C}_p\pm t\sqrt{\frac{\hat{V}(\hat{C}_p)}{a}}$$

Data Analyses

Missing Data

- Days open for fishing but not monitored – daily estimates only. Effort is estimated based on average effort seen from Tuesday thru Friday for weekdays and the other weekend day for weekends. C/E is estimated using the surrounding days data, up to a week away.

- Bihourly net count missed – adjacent net counts are averaged to estimate missing net count.

Analytical Methods

Assumptions

- Weekend effort is different from weekday effort
  - When estimating effort for days not monitored, weekday effort is estimated from monitored weekdays, weekend from weekend days
- Estuary effort and catch/effort fluctuates with tides
  - constant collection of C/E throughout the day and bihourly net counts account for most of the variation
- Night hours C/E is different from daylight hours C/E
  - Day and night shift allow different C/E for the two periods
- Jack proportion for angling and dip nets is different from jack proportion for gill nets
  - Jacks estimated separately for gill nets and other gear

Project Reporting

1. Estimates are reported on the Fisheries website, updated weekly unless harvest is nearing the quota, when report is updated daily. A draft report is generated typically in March of the following year.

2. The original data sheets are stored physically in binders, and will be scanned and stored electronically post-season. The base data are in dBase files stored on a network server and backed up to local hard drives daily.

Yurok Tribal Fisheries Monitoring

Issues/Challenges

1. Ice has created a challenge for collecting biological data, especially in the estuary during commercial fisheries. The fishers have been trained to ice their fish, and they are then reluctant to have the monitors pull the fish out for sampling.
2. Uncooperative fishers can be a challenge occasionally; people who may hide fish or evade fish monitors.
   a) If we don't have confidence in our contact with them, then we don't use data.
      i. Can always count effort and use c/e from more reliable contacts.
3. During commercial fisheries, can be a challenge keeping Mid-Klamath subsistence fish from entering commercial fishery.
   a) Not a total harvest estimate problem, but an internal issue regarding subsistence vs. commercial allocations and quality control
4. Variance estimator has recently be revitalized, could use review.

Information gained from this project

- This project provides information necessary to address the following assessment identified in the TRRP IAP (V1.0):
  - 4.1.2 , 4.2.2, 4.3.2, 4.4.2, 4.6.2 Increase harvest of naturally produced fall-run Chinook salmon, spring chinook salmon (first 2-3 weeks of August), coho salmon, steelhead, and green sturgeon.
- Harvest information that is used for management purposes such as stock projection, cohort reconstruction, TRRP goal assessments
  - Scales for age composition
  - CWT's for hatchery/natural assessments, cohort reconstruction, etc…
- Coho hatchery/natural composition information for fall chinook and coho salmon

Effect on Management

- Yurok Tribal harvest is a significant component of each year's run of anadromous fish; particularly fall Chinook. Estimating the harvest, collection of CWTs, mark information for coho salmon, and collection of scales for age analysis are essential for:
  - Responsible harvest management
  - TRRP assessments of factors affecting brood strength (analyses that are ripe for more attention)
  - Assessment of whether Program goals are being met (such as full participation in fisheries)

Tribal Harvest on Trinity - Hoopa

Hoopa Valley Tribal Fisheries Department

Billy Matilton/George Kautsky

Trinity River Restoration Program

Adult Monitoring Evaluation Workshop

October 26-27, 2011

Project Background

- The primary goal of this study is to provide a total estimate of Hoopa Tribal harvest of fall and spring Chinook, coho salmon, and steelhead.
- Hatchery contributions of target species are estimated through recovery of hatchery marks and tags.
- Contributions of naturally produced target species are estimated providing the Program with a tool to assess the naturally produced adult goals for TRRP.
- CWT data are also useful for correcting bias in the estimates of scale-based age structures for fall Chinook.

Tribal Harvest on Trinity - Hoopa

Project Objectives

–Project objectives support the overall goal for estimating an un-biased estimate of total harvest by species within the Tribal Fishery. This includes conducting weekly harvest estimates based on randomly selected days within a week, recording total effort within sample day, and conducting field interviews of Tribal fishers to estimate expected catch per 'net-night'.

–Data gathered by this effort are supportive to multiple objectives within the TRRP's IAP:

Assessment	Description	IAP Level 1 Objective
17A	Monitor harvest (tribal, sport and commercial) of naturally produced fall Chinook	Restore and sustain natural production of anadromous fish populations downstream of Lewiston Dam to pre-dam levels, to facilitate dependent tribal, commercial, and sport fisheries' full participation in the benefits of restoration via enhanced harvest opportunities.
22A	Develop cohort reconstructions for Chinook and coho and evaluate cohort performance or year class strength, and population growth rate	
16A	Monitor harvest (tribal, sport and commercial) of naturally produced spring Chinook	
18A	Monitor harvest (tribal, sport and commercial) of naturally produced coho	
19A	Monitor harvest (tribal, sport and commercial) of naturally produced steelhead	

How does this project support the Trinity River Restoration Program?

- This project contributes to assessing the success of the TRRP goal.

  "…to restore and sustain natural production of anadromous fish populations downstream of Lewiston Dam to pre-dam levels, to facilitate dependent tribal, commercial, and sport fisheries' full participation in the benefits of restoration via enhanced harvest opportunities..."

- Data from this project, when comprehensively integrated with similar estimates of harvest by-species within other sectors, and spawning escapement estimates for Trinity River naturally produced fish, enable subsequent age-structured estimates of cohort performance which may be tied to management actions in subsequent analyses.

Field Methods

1. sampling methods/protocols

- Subsample the fishery on four randomly selected days per statistical week.
- Average catch per net-night is estimated by completing interviews with as many fishers as logistically is feasible (typically 60-80% of fishers are interviewed on a sampled day).
- Collect data on catch by individual fishers including total caught, species composition.
- Collect biological data from sampled fish in the fishery (CWT, lengths).

2. areas surveyed

- Trinity River Mainstem within the exterior boundaries of the Hoopa Valley Indian Reservation

Tribal Harvest on Trinity - Hoopa

Field Methods

3. sampling effort – time period and days/week

SPECIES/ MONTH	J	F	M	A	M	J	J	A	S	O	N	D
LAMPREY												
GREEN STURGEON												
SPRING CHINOOK												
FALL CHINOOK												
COHO SALMON												
STEELHEAD												

Analytical Methods

1. Data management, QA/QC procedures
   - DBase programs were developed for data archival and reduction functions
   - Plans for sample design are supervised and executed consistent with program needs
     - Samplers are trained and then performance monitored to ensure optimal coverage of fishing effort
   - Relational data base and consistent practices ensure control, protection, delivery of data and information assets
     - Data recorded on paper forms which are templates from DBase data reduction application
     - Data are entered into DBase for analysis by reduction programs
     - Data analyses (estimation methods)
1. Estimators used
   a. Precision of estimates (provide examples of previous data if available)

Analytical Methods

Within sampled days

N = Nets counted (= day total nets fished)
n = Nets sampled
i = Sampled net index
h_i = Sampled harvest in ith net
H = Estimated harvest
j = Sample day index

Day j estimated harvest = H_j $= \sum_{i=1}^{n} h_i * \frac{N}{n}$

Day j between-net variance in harvest = V_{bj} $= \frac{\sum_{i=1}^{n} h_i^2 - \frac{\left(\sum_{i=1}^{n} h_i\right)^2}{n}}{n-1}$

Finite population correction for random non-replacement sampling = $\frac{N-n}{N}$

Day j variance of estimated total harvest $= V_{hj}$

$$= \frac{V_{bj}}{n} * N^2 * \frac{N-n}{N}$$

$$V_{hj} = V_{bj} * \frac{N}{n} * (N-n)$$

Analytical Methods

Within Week

D = Days fished
d = Sampled days
j = Sample day index
H_j = Estimated harvest on jth sampled day
k = sampled week index

Week k estimated total harvest = $H_k = \sum_{j=1}^{d} H_j * \frac{D}{d}$

Between-day variance in harvest = $V_{bk} = \frac{\sum_{j=1}^{d} Hj^2 - \frac{\left(\sum_{j=1}^{d} H_j\right)^2}{d}}{d-1}$

Week k variance of estimated total harvest = V_{hk}

$$V_{hk} = \left[V_{bk} * \frac{D}{d} * (D - d) \right] + \left[\left(\sum_{j=1}^{d} V_{hj} \right) * \frac{D}{d} \right]$$

Approximate* 95% confidence interval of week estimated total harvest

$$= H_k \pm (t_{0.05, d-1} * \sqrt{V_{hk}})$$

* In the formula above, degrees of freedom for the t-statistic is computed from the first-stage (days within weeks) sampling. It is not clear how to incorporate second-stage sampling (nets within days) into the determination of degrees of freedom. Simulation experiments have suggested that confidence intervals computed using $t_{0.05, d-1}$ are approximately equivalent to 93% or 94% confidence intervals.

Analytical Methods

Season totals

k = sampled week index
W = total sampled weeks

Season total estimated harvest

= sum of week estimates $= \sum_{k=1}^{W} H_k$

Variance of season total estimated harvest

= sum of variances of week estimated totals $= \sum_{k=1}^{W} V_{hk}$

Approximate* 95 % confidence interval of season estimated total harvest

$$= \sum_{k=1}^{W} H_k \pm t_{0.05,W-1} * \sqrt{\sum_{k=1}^{W} V_{hk}}$$

(* Degrees of freedom for t-statistics are unknown.)

Analytical Methods

- How are missing data issues are addressed
  - N/A
- Power analyses conducted to determine sample size
  - None Completed

- 6.c. Assumptions used in the analyses and support for their validity (i.e.: direct testing of assumptions or other evidence that supports the validity of the assumptions)
  - A key assumption is that total effort is obtained on a particular sampled day. Concern that field sampling by motor vehicle may miss effort is addressed by addition of river access by jet boat. Total net count by jet boat is then compared with that observed by motor vehicle and adjustment is made if necessary to account for otherwise missed effort.

Project Reporting

1. Reporting of information – in-season, preliminary reports, final reports
   - Information gathered in this assessment becomes of value to the TRRP once season totals are obtained. Typically by early February a preliminary report is available with a final report following by late spring summarizing total catch of species of interest, decomposed into natural and hatchery origin fish.

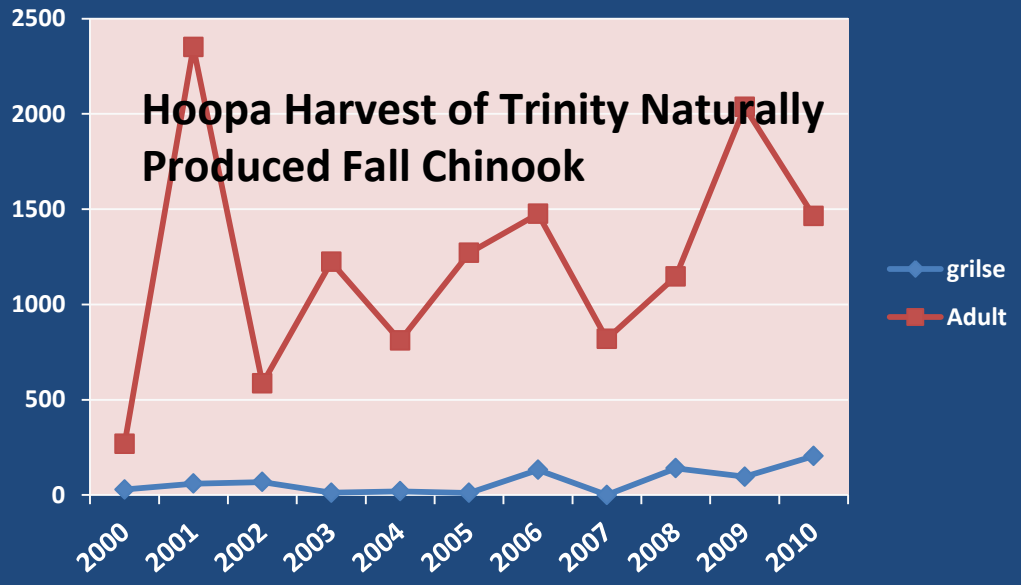
2. Data storage
   - Data are retained in DBase format at HVT Fisheries Office, and may be provided to TRRP in desirable formats.

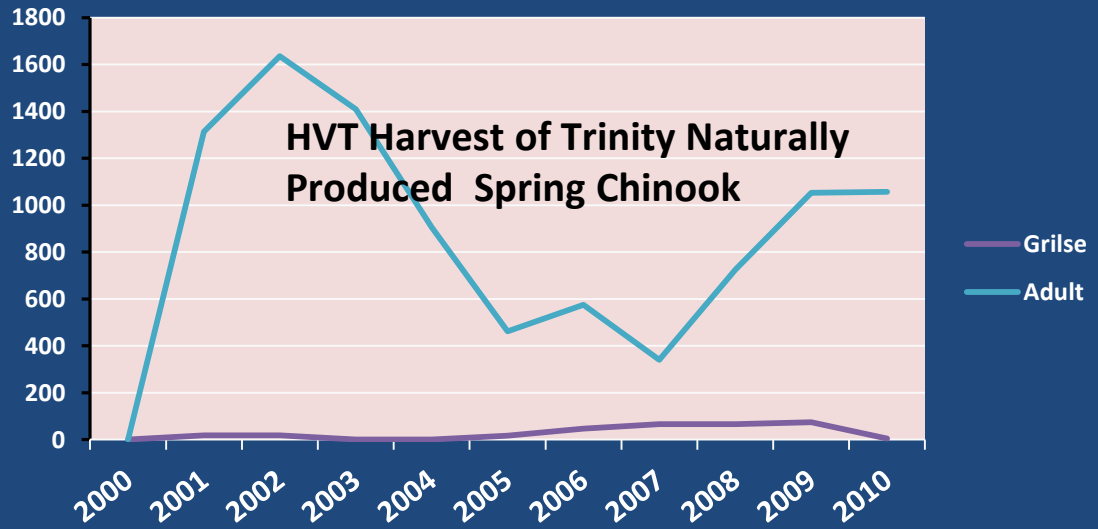
Issues/Challenges/Feedback to TRRP

1. Explain any issues/challenges that have occurred and how these influence the ability of the project to meet its objectives.
    - TRRP irregular funding stream results in fractioning inter-annual continuity of species-based assessments within this project and across projects within an assessment. A longer term commitment to the comprehensive collection of data across the species of interest should be implemented to ensure future TRRP value of these data.
2. Present what we have learned from implementing this project (even preliminary analyses) in assessing the effectiveness of the TRRP.
3. How does this information relate to evaluating and/or recommending management actions (linking back to information presented in slide #4)

Tribal Harvest on Trinity – Hoopa

Present what we have learned from implementing this project (even preliminary analyses) in assessing the effectiveness of the TRRP.





Issues/Challenges/Feedback to TRRP

3. How does this information relate to evaluating and/or recommending management actions (linking back to information presented in slide #4)
    - The information gathered in this project is not useful in adjusting management on the short time scale (1-5 years). However, on the generational and decadal scale this information, when combined to other projects, results in an assessment by species, that evaluates the trend in achieving TRRP's core goal for restored dependent fisheries.
    - Comprehensive information gathered from this and associated monitoring activities provides input for assessments such as the cohort model for Trinity origin fall Chinook is useful in evaluating progress on this goal.
    - Additional analyses to further explain performance of Trinity River naturally produced Chinook as a function of ocean survival would be add further value to such assessments.

Klamath River Fall-run Chinook Scale Age Analysis

Yurok Tribe

George Kautsky/Desma Williams

Trinity River Restoration Program

Adult Monitoring Evaluation Workshop

October 26-27, 2011

Project Background

Prior to 1991, the age composition of the inriver run was estimated by using a combination of: (1) scale analysis from a beach seining study conducted in the estuary and (2) the age composition of coded wire tagged fall chinook (fingerling releases) that returned to Iron Gate and Trinity River Hatcheries. Due to termination of the beach seining project and concerns that coded wire tagged hatchery fish may not reflect the age composition of the entire run, analysis of fall chinook scales collected from spawner surveys and fisheries throughout the Klamath-Trinity Basin has been utilized since 1992. Since 1985, the age composition of the inriver run has been used in conjunction with the post season run size estimate to project the fall chinook run size for the following year.

Project Objectives

This project determines the age of fall and spring-run Chinook salmon sampled from Trinity River Tribal and recreational fisheries at weirs, in the brood stock at TRH, and on the natural spawning grounds. The project is also used to determine the age of fall Chinook salmon sampled from the Yurok Fishery, the Lower Klamath Recreational fishery, and Klamath tributary and mainstem spawning surveys.

Objective: Estimate brood-year contributions of hatchery and naturally produced returns of spring and fall Chinook salmon.

How does this project support the Trinity River Restoration Program?

The estimation of brood-year abundance allows for an assessment (via cohort reconstruction) of recruitment prior to harvest impacts, which allows for an assessment of the success of restoration activities. The age composition of the fall Chinook run also enables forecasts of ocean population size and projected river returns of adult fall Chinook; essential information for the management of fisheries. The performance of particular broods can then be partitioned into hatchery and natural components (via analysis of coded wire tag recoveries in the fisheries and other locations of the Basin).

Sampling Methods/Areas Surveyed

Scales from the Klamath River are collected by various agencies and volunteer groups, including the inriver sport fishery, the Yurok fishery, Iron Gate Hatchery, and spawner/carcass surveys in the Shasta, Salmon, Scott and various Middle Klamath tributaries.

Scales from the Trinity River are sampled from Trinity River Tribal and recreational fisheries, at weirs, in the brood stock at TRH, and on the natural spawning grounds.

Aging Methods

Ages are assigned to recovery sectors through visual examination of scale patterns for samples gathered in fisheries and spawner escapement. Read-scale age is then corroborated and adjusted for reader bias using coded-wire tag (CWT) data.

Up to 1200 scales from each collection area from the Klamath side are mounted and aged. If there are more than 1200 scales from an area, the proportion of the scales that are excess is determined, and sufficient packets are removed at regular intervals to bring the total down near 1200.

Scales are mounted, pressed into acetate, and the pressings aged independently by two people. Discrepancies are resolved by a third read.

Aging data is corrected for reader bias using a maximum likelihood estimator.

Data Management

Data from the Klamath scales are entered on data sheets as the scales are mounted. These data are then entered in a dBase table. Age data is added as scales are read. A dBase program sums the various inputs necessary for the Kimura reader bias correction process, which are then transferred to an Excel spreadsheet with the Kimura procedure.

•Data from the Trinity scales are entered excel as the scales are mounted. These data are then arranged into matrices which compare read scale assigned Age with instances of know age. Reader bias correction is implemented via procedures described by Cook and Lord (1978) and Cook (1983). Corrected read-age tables are then generated to assign ages to recovery sectors.

Estimators/Missing Data

Aged scales are corrected for reader bias, resulting in a corrected proportion at age for each scale collection area. Populations from each area have been estimated, and the appropriate corrected age proportions are applied the estimate, giving an estimated number of fish at age in that population.

Jacks in a given area may be estimated using the scale ages, or by fork length cutoff or other estimation method if the jack proportion from scale aging seems unreasonable or scale sampling suspected to be biased.

In some cases, individual collection areas may produce too few scales to reasonably use them to estimate age breakout. In these cases, a surrogate is used, based on one or more of nearby recovery sectors with adequate sample sizes and presumed comparable age structure.

Assumptions

Scale samples are representative of the population sector being represented.

The statistical bias-correction methods employed are intended to correct for scale-reading bias, but the methods assume that the known-age, read-age validation matrices are themselves well-estimated

Project Reporting

Age structures for Chinook will be provided to co-managers from which models may be updated to link performance of successive year classes of Chinook production by recovery sector. Past age structure data (up to 10 years) for spring Chinook and current year data will simultaneously be transmitted to the Program contact.

The process and results of the Fall Chinook Age Composition project will be summarized into a report prepared by the Klamath River Technical Advisory Team.

Data Storage

Trinity:

Data are collected and stored electronically in Microsoft Excel. Lookup tables for CWTs created in D-Base are transferred into Excel.

Klamath:

Individual scale data are stored in a dBase table. Various subsets of this data are organized and saved to an Excel spreadsheet with the Kimura reader bias correction procedure. Data is stored on a network server and backed up to local hard drives daily.

Issues/Challenges

1. Inadequate scale sample size from individual sample areas: Appeal to surrogate collections believed to be representative of the specific sector
2. What We've Learned:

   Age structured analyses have allowed the TRRP to develop a Trinity River fall Chinook-specific cohort reconstruction to gain insight on the performance of successive broods of Trinity Natural origin Chinook and their contributions to fisheries

   Forecasts of ocean stock size of Klamath River fall Chinook enable rationale fishery management which when coupled with TRRP management actions contribute to the sustainability and enhancement of this stock.

Information

This project provides information necessary to address the following assessment identified in the TRRP IAP (V1.0):

- 13A - Monitor adult escapement of hatchery & naturally produced spring & fall Chinook, coho & fall steelhead
- 17A Monitor harvest (tribal, sport & commercial) of naturally produced fall Chinook
- 22A Develop cohort reconstructions for Chinook & coho & evaluate cohort performance or year class strength, & population growth rate
- 16A Monitor harvest (tribal, sport & commercial) of naturally produced spring Chinook
- 23A Model the variation in brood year performance for Chinook & coho attributable to in-river conditions & ocean conditions

Cohort Reconstruction

Hoopa Valley Tribal Fisheries Department

George Kautsky/Eric Logan

Trinity River Restoration Program

Adult Monitoring Evaluation Workshop

October 26-27, 2011

Cohort Reconstruction
Project Background

•Information relative to marine harvest and river run of Klamath River Fall Chinook dates back to the late 1970s with the advent of coded-wire-tagging for fish released from the Trinity River and Irongate Hatcheries.

•The TRRP has supported numerous field census projects wherein total catch and escapement for fall Chinook have been obtained since 2000.

•This project synthesizes data obtained from several monitoring activities within the Adult Fish domain of the TRRP together with historic records of river run and CWT recovery from marine fisheries.

•With its initial focus on fall Chinook, this assessment enables the TRRP to review performance of sequential broods of Trinity River naturally produced fall Chinook by summing their contributions to fisheries, accounting for non-landed catch mortality, natural mortality, and escapement, by age, across the life span of successive cohorts.

•A fundamental requirement is that Trinity origin fish be recognized in mixed stock fisheries by hatchery marks.

•Assumptions about marine survival, vulnerability, contact, and non-landed catch mortality are incorporated from generalized Klamath fall Chinook cohort models developed by PFMC/STT.

Project Objectives

- Link hatchery CWT and production release data with CWT recovery and total river run in an age-structured database.
- Estimate population parameters for Trinity River fall Chinook for use in the development of a full life cycle model.
- Analyze the effects of TRRP actions on cohort size and cohort replacement rates.
- Estimate contributions of naturally produced fish to dependent fisheries

Assessment	Description	IAP Level 2 Objective
22A	Develop cohort reconstructions for Chinook and coho and evaluate cohort performance or year class strength, and population growth rate	4.1 Increase naturally produced fall-run Chinook salmon adult production to the extent necessary to meet or exceed escapement objectives and facilitate expanded harvest opportunity

How does this project support the Trinity River Restoration Program?

- Age-Structured population assessments will improve our understanding of factors that influence contributions to fisheries and river escapement of natural anadromous fish.

- Trends in the Cohort Replacement Rate, will help characterize the combined effects of TRRP management actions (flow and physical habitat manipulations) in an Adaptive Management framework..

Field Methods

1. sampling methods/protocols
   - Marine and terminal recovery data are obtained through an interagency effort pursuant PFMC's annual salmon assessment and management process.
   - In each return year, age-specific escapement estimates, coupled with the CWT release and recovery data for TRH, allow for a cohort reconstruction of the hatchery and natural components of Klamath River fall Chinook (KRTAT 2003; Goldwasser et al. 2001).

2. areas surveyed
   - System/Migration Wide
   - Data originate from sampling of marine and terminal fisheries and escapement areas

3. sampling effort – time period and days/week
   - Multiple Agencies participate in aspects of this consolidation effort

Cohort Reconstruction
Analytical Methods

a. Data management, QA/QC procedures

- Records of all Klamath CWTs recovered on the west coast since 1978 are downloaded from the Pacific States Marine Fisheries Commission's Regional Marking Information System (RMIS) (Johnson 1990, RMPC 1997) into ALLKOHMREC.dbf.
- Terminal CWT recovery data are provided by CDFG/Santa Rosa
- CWT Data are extensively error checked for accuracy by the provider.

b. Data analyses (estimation methods)

- Cohort Reconstruction analysis sums all sources of mortality starting at the oldest age of a particular brood which is usually age-5 in river and proceeds backward in time to the youngest age observed, usually age-2 in river.
- The estimation of the brood's ocean abundance is conducted at the beginning of each month and is a function of harvest, sublegal mortality, drop off mortality and natural mortality.

c. Precision of estimates (provide examples of previous data if available)--N/A

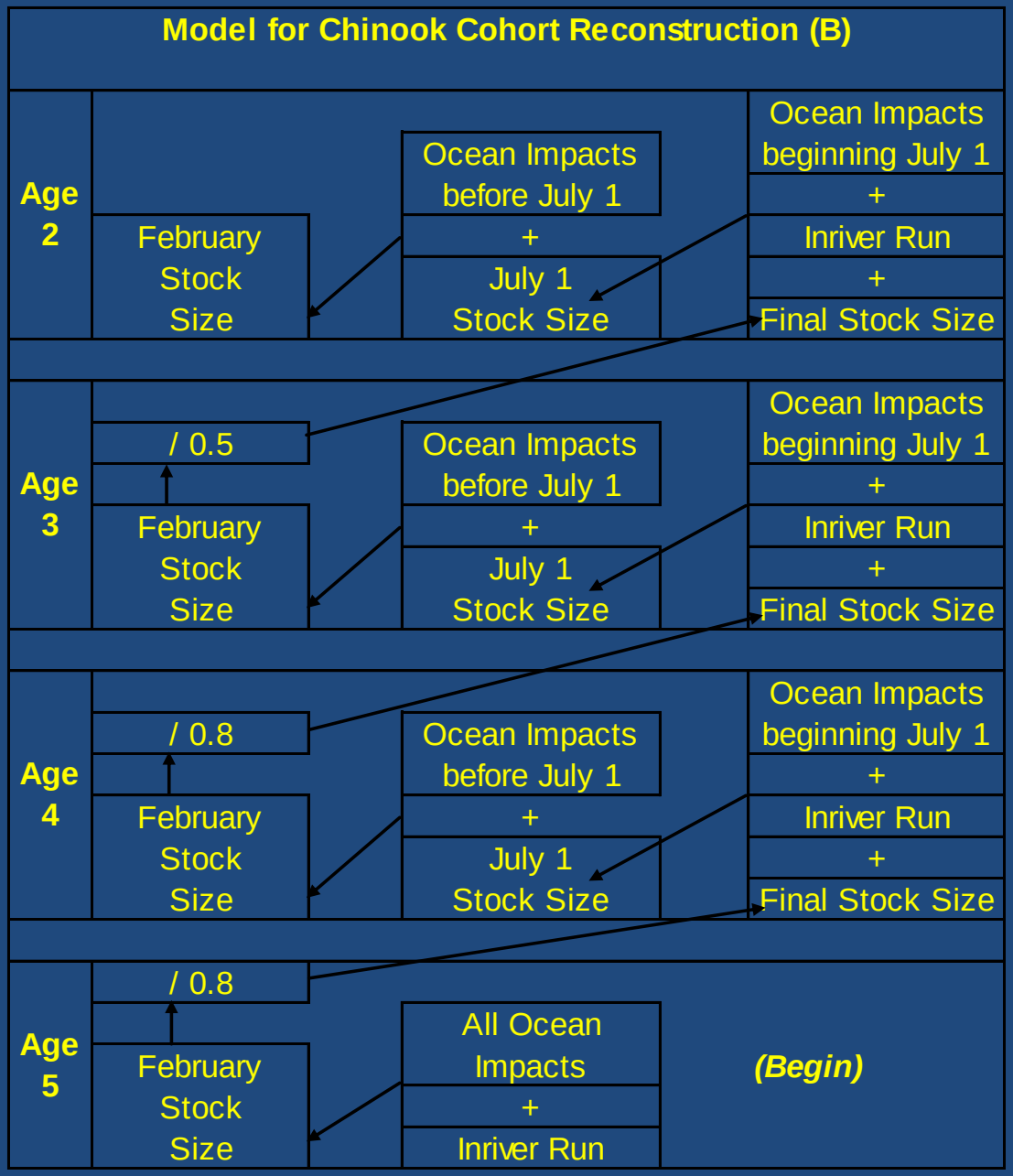
d. How are missing data issues are addressed?—Fisheries and most recovery areas are sub-sampled and expansions are developed specific to each area. The case of "missing Data" is undefined

e. Power analyses conducted to determine sample size—N/A

f. Assumptions used in the analyses and support for their validity (i.e.: direct testing of assumptions or other evidence that supports the validity of the assumptions)(See: Goldwasser et al. The supporting databases and biological analyses for the revision of the Klamath Ocean Harvest Model. 27 April 2001)

- Ocean hook-and-release ("shaker") mortality rates
- The ocean dropoff mortality rate
- The ocean natural mortality rate

Chinook Cohort Model



Start with oldest ages and work to youngest

Assumed Overwinter Survival

Marine Fishery Impacts

Mixed-Stock Terminal Fishery

Use CWT TRH origin Chinook, then bring in Natural Origin fish based on their annual proportions at age in river.

Mixed-Stock Terminal Fishery calculation by age

- **(A) Yurok Fishery:**

$$YT_{TRFC} = YT_{TRHFC} * TB_{TRFC}/TB_{TRHFC}$$

- **(B) Lower Klamath Rec. Fishery** (CWT recovery data was inadequate)

$$LK\ Sport_{TRFC} = LK\ Sport_{FC} * TB_{FC} / (KB_{FC} + TB_{FC})$$

YT = Yurok Tribe
FC = Fall Chinook
TR = Trinity River
TB = Trinity Basin
H = Hatchery-origin
N = Natural-origin
KB = Klamath Basin
LK = Lower Klamath

Note: 2002 fish kill broken out like A.
Hoopa and Yurok reservation natural spawners 1997-98 broken out like B.

Project Reporting

1. Reporting of information – in-season, preliminary reports, final reports
   - Model operates in FoxPro and is updated annually and summaries provided per guidance of the TRRP's Fish Work Group

2. Data storage
   - Data are stored in FoxPro & DBase.

Issues/Challenges/Feedback to TRRP

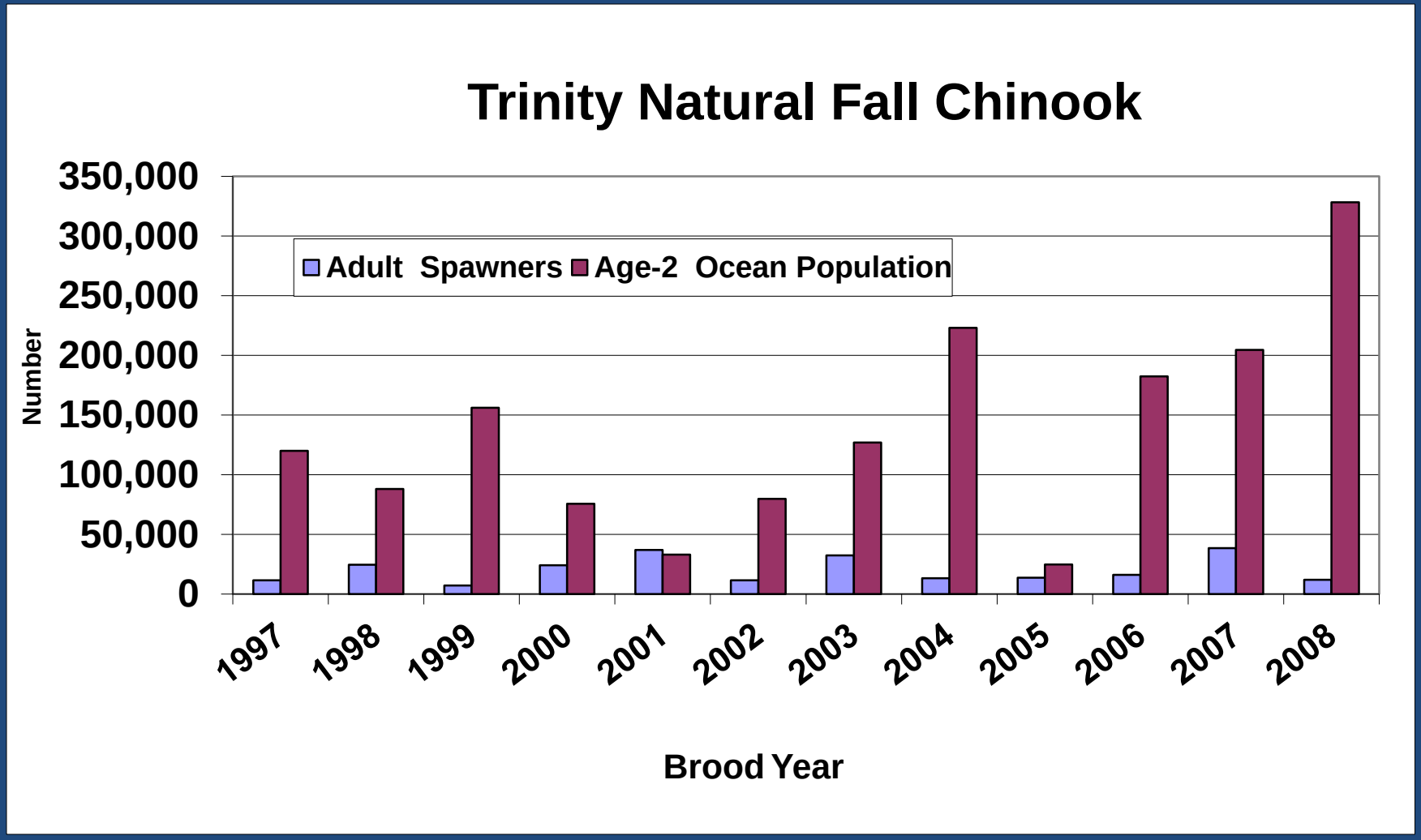
1. Explain any issues/challenges that have occurred and how these influence the ability of the project to meet its objectives.
   - An improved cooperative network has been in place since 2008 wherein standardized and error checked CWT terminal recovery data archived by CDFG have become available to TRRP partners
   - Assumed marine natural mortality is not verifiable.
2. Present what we have learned from implementing this project (even preliminary analyses) in assessing the effectiveness of the TRRP. (see succeeding slides for examples).
3. How does this information relate to evaluating and/or recommending management actions (linking back to information presented in slide #4)
   - Information developed under this assessment enables TRRP to estimate brood replacement rates, a fundamental metric for modeling population dynamics. Certainly, multiple assumptions lead to this estimate and appeal to results of a cohort model must be compared with other assessments of TRRP performance.

Cohort Reconstruction Trinity Fall Chinook

		Age 2				Age 3				Age 4				Age 5		
Brood Year	Release Stage*	May Ocean Pop	Ocean Impacts	River Run	November Ocean Pop	May Ocean Pop	Ocean Impacts	River Run	November Ocean Pop	May Ocean Pop	Ocean Impacts	River Run	November Ocean Pop	May Ocean Pop	Ocean Impacts	River Run
1995	F	6852	0	426	4466	3158	99	2285	534	477	0	443	0	0	0	0
1995	W	50966	0	4012	32413	22920	61	16020	4634	4145	23	3300	61	55	1	45
1995	Y	72275	0	504	50657	35820	303	22044	10501	9392	1039	7624	80	71	0	66
1996	F	14088	0	299	9695	6855	123	3228	2906	2599	252	2148	23	21	0	19
1996	W	19119	0	2507	11254	7958	0	3199	3916	3502	86	2796	49	44	1	38
1996	Y	10907	0	17	7698	5443	0	1654	3275	2929	342	2261	44	40	0	37
1997	F	63737	0	2492	42848	30268	2217	18525	7096	6347	477	5291	139	124	33	82
1997	W	95235	0	3586	64101	45293	371	11203	26445	23585	409	17487	2116	1879	22	1452
1997	Y	99887	0	1314	69460	49097	2597	23686	18596	16569	998	14293	176	158	4	142
1998	F	10666	0	551	7051	4986	343	3290	967	827	258	555	0	0	0	0
1998	W	69942	0	3862	45967	32454	128	15310	11882	10444	120	8071	0	0	0	0
1998	Y	62637	0	1350	43086	30434	1393	21723	4936	4372	654	3419	0	0	0	0
1999	F	34717	0	365	24223	17080	1073	5125	9306	8263	2306	5027	442	367	115	258
1999	W	123883	0	1779	85991	60749	184	11441	40646	35377	996	14956	4856	4140	252	1923
1999	Y	72568	0	94	51229	36225	1133	3375	28046	24278	6313	16748	421	331	150	205
2000	F	62134	0	2566	41396	29122	7343	15151	4116	3525	1844	1564	50	36	20	22
2000	W	60094	0	1608	41040	28944	172	8011	12577	10723	652	2756	1666	1426	52	1168
2000	Y	86143	0	711	60250	42572	5076	19812	13856	11809	6330	5072	315	260	93	174
2001	F	7570	0	424	4972	3515	1164	1396	694	606	71	465	43	39	0	36
2001	W	26327	0	1378	17370	12264	144	0	7169	6138	225	1708	700	626	1	556
2001	Y	88346	0	637	61899	43724	10191	21976	8325	7129	2001	4737	227	203	0	188
2002	F	42582	31	2190	28133	19875	1183	9383	7627	6821	244	5897	186	167	57	99
2002	W	63343	0	4544	40667	28735	20	8428	16025	14333	34	10819	1436	1265	101	594
2002	Y	39564	0	411	27610	19508	613	7362	9762	8731	336	7563	205	172	41	131
2003	F	4043	0	45	2819	1993	106	1075	648	566	367	180	5	4	0	0
2003	W	100827	0	1419	70014	49507	406	2420	39995	35240	2808	7714	516	461	2	418
2003	Y	11871	0	12	8383	5928	121	3350	1958	1734	938	699	10	9	0	8
2004	F	49895	18	6940	29008	20512	4400	11961	2620	2337	7	2149	15	13	0	13
2004	W	177001	0	7394	118449	83756	611	39311	22843	20415	101	14719	3682	3293	0	2911
2004	Y	47092	0	982	32424	22927	1970	14139	4912	4394	67	3944	56	50	0	46
2005	F	1737	0	0	1228	868	0	651	150	134	8	110	7	6	0	6
2005	W	19666	0	1067	12942	9151	0	2171	5987	5355	0	4327	397	355	13	288
2005	Y	7548	0	74	5271	3727	20	2637	774	692	19	596	15	14	13	0

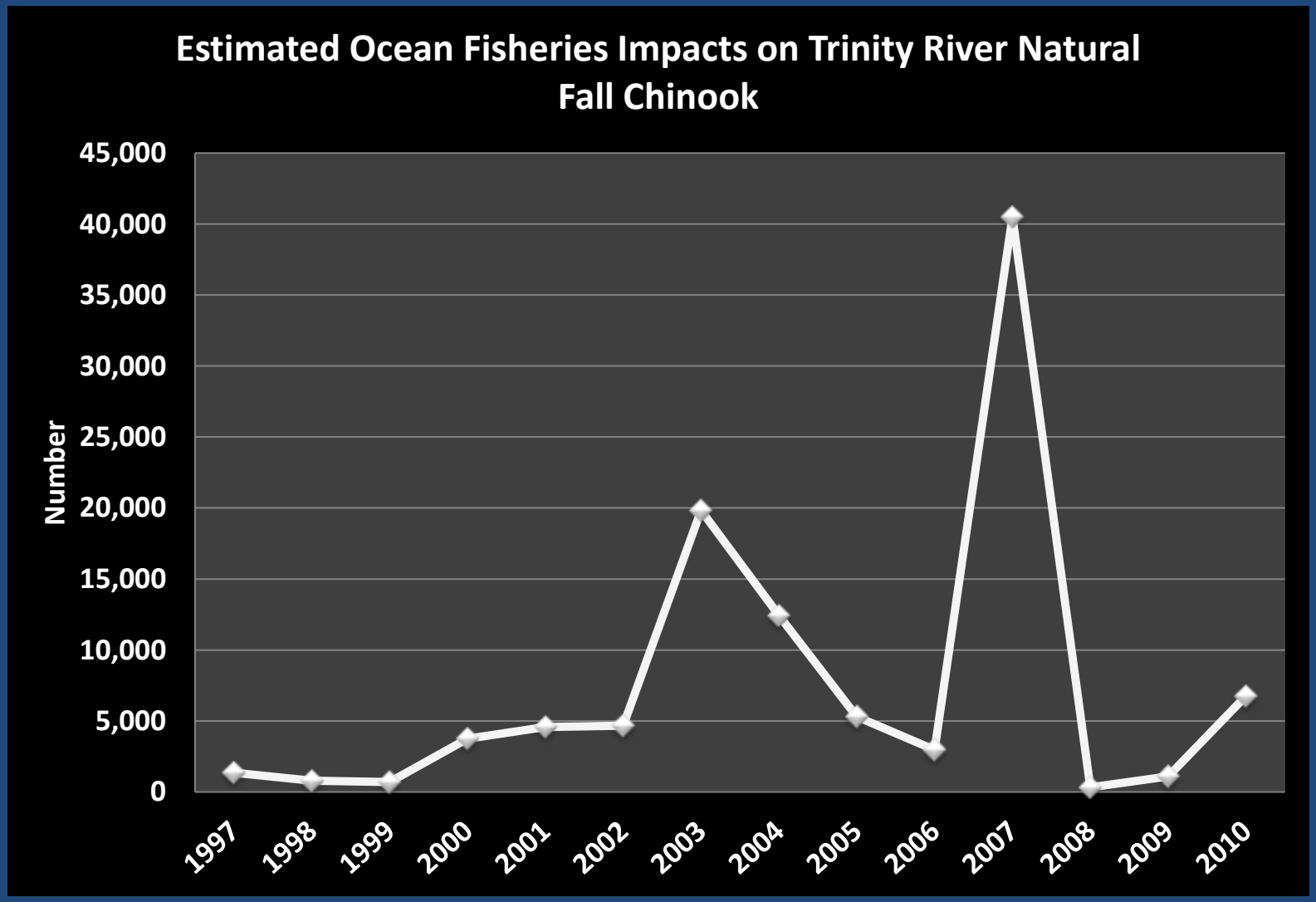
Preliminary Draft

Trinity Natural Fall Chinook
Adult Spawners and Age-2 Recruits (individuals that survived river out-migration and first winter at sea)



Preliminary Draft

Trinity Natural Fall Chinook



Preliminary Draft

Trinity River Chinook Salmon Spawning Survey
Carcass Survey

California Dept. Fish and Game, United State Fish & Wildlife Service, Yurok Tribal Fisheries, Hoopa Valley Tribal Fisheries, and United States Forest Service

Presenter Andrew Hill, CDF&G

Trinity River Restoration Program

Adult Monitoring Evaluation Workshop

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Arcata, CA

Carcass Survey Backround

- The first Chinook carcass surveys on the Trinity River documented sex ratio and pre-spawn mortality data from the Lewiston area in 1942 , 1944, and in 1945 included the Trinity Center area. *(Moffett and Smith* 1950*)*

- In 1955, 1956, 1963, 1965, 1968, 1969,1971, and 1972 carcass surveys were performed for Chinook. *(Gibbs* 1956, *Weber* 1965, *La Faunce* 1965, *Rogers* 1970, *Smith* 1975, *Rogers* 1971)

- 1987 to 1997 Chinook surveys on the Trinity River were performed in addition to a few select tributaries. (California Department of Fish and Game)

- 2000 to present the Trinity River Carcass survey has been funded by T.R.R.P. in the upper 40 miles , and expanded below the gorge in 2007. (California Department Fish & Game Annual Reports to the T.R.R.P. year 2000 to current)

Spawning Survey Objectives

Survey provides information for meeting the following objectives Identified In the Trinity River Restoration Program's (T.R.R.P.) Integrated Assessment Plan (I.A.P.)

- **3.1.3** Reduce temperature related pre-spawning mortality and protect in-vivo egg viability of anadromous spawners in the mainstem Trinity River.
- **3.3.3** Minimize impacts of predation and genetic interactions between and among hatchery and natural anadromous fish.
- **4.1.1** Increase escapement of naturally produced fall Chinook Salmon adults to 62,000.
- **4.2.1** Increase escapement of naturally produced spring Chinook Salmon adults to 6,000.

How does this project support the Trinity River Restoration Program?

- By collecting pre-spawn mortality data to assist in determining the effectiveness of TRRP restoration projects and thermal control of the Trinity River. (I.A.P. 3.1.3)
- By describing the temporal and spatial distribution of natural and hatchery origin Chinook spawning in the Trinity River to assess competition with naturally produced Chinook. (I.A.P. 3.3.3, 4.1.1, 4.2.1)
- By providing age-structure and spring/fall Chinook separation by Coded Wire Tag (CWT) analysis. (I.A.P. 3.3.3, 4.1.1, 4.2.1)
- By providing in-river escapement summaries and estimates for both spring and fall Chinook to the Trinity River. (I.A.P. 3.3.3, 4.1.1, 4.2.1)

Field Methods

1. Two raft crews of two surveyors per raft with fixed intervals over the course of recovery sampling

- Carcasses retrieved with extendable poles equipped with spear-fishing tips.
- Biological data collected from carcasses and examined for marks.
- Hatchery marked Chinook carcasses are taken back to the office for CWT extraction and reading
- Fresh (Condition 1) carcasses are marked with numbered carcass tags to form the framework for mark-recapture analysis.
- All data is collected either on paper or on a tablet pc.

Field Methods

2. Area surveyed

   Trinity River from the Lewiston Dam to Cedar Flat (101.6 river kilometers) and from Hawkins Bar to Weitchpec (64.1 river kilometers). Cedar Flat to Hawkins Bar is not surveyed due to safety concerns (14.4 river kilometers).

3. Sampling effort – time period and days/week

   - From September to December Lewiston Dam to confluence with the North Fork Trinity River (upper 40 miles) is surveyed once a week.
   - All sections below are surveyed once every other week.

Analytical Methods

1. Data management, QA/QC procedures

   All data is entered and stored in an Access database.

2. Data analyses (estimation methods)

   a. Four closed population estimators are used

      Peterson, Stratified Peterson, Schaefer, Schaefer with Law's adjustment

   b. Precision of estimates (provide examples of previous data if available)

Table 1. 2009 and 2010 Mark-recapture estimates for the Trinity River Carcass Survey

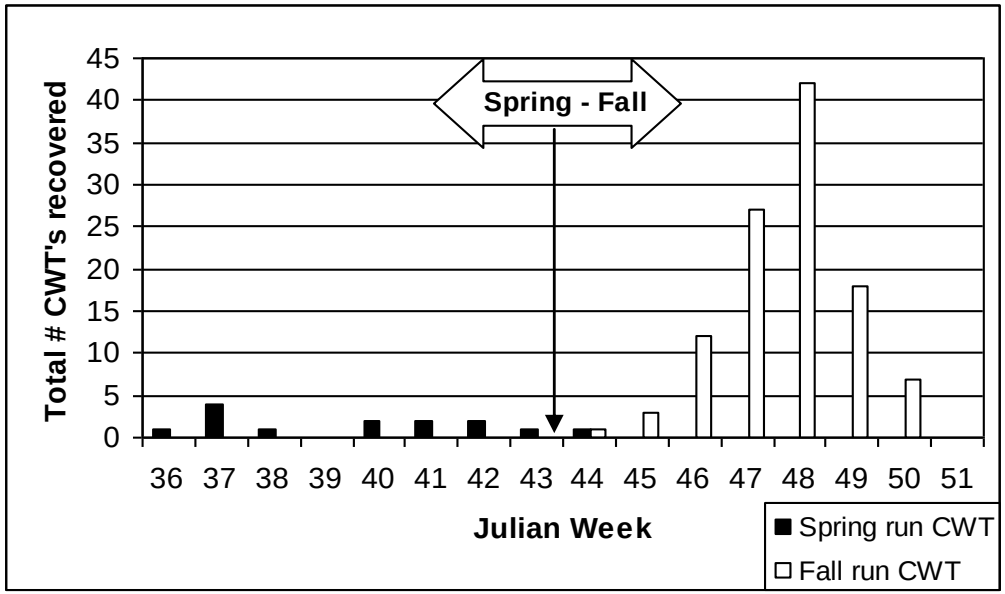
	2010 a/				2009 b/			
Estimator	Reaches 1-14	95% CI	Reaches 1-5	95% CI	Reaches 1-14	95% CI	Reaches 1-5	95% CI
Peterson	11,426	1,238	9,004	956	10,027	1,003	6,463	675
Weekly Stratified Peterson	11,508	1,240	8,916	995	13,372	1,703	8,754	1,115
Schaefer	11,272	1,241	8,705	973	9,590	873	8,389	697
Schaefer with Law's adjustment	10,668	1,241	8,198	973	8,899	873	7,797	697

a/ in 2010; 3,871 Chinook captured, 604 marks applied, 204 recaptured
b/ in 2009; 3,419 Chinook captured, 691 marks applied, 235 recaptured

Analytical Methods

3. Spring/Fall Chinook separation—based on CWT recovery

Julian Week	Spring-Run CWT recovered	Fall-Run CWT recovered
36	1	
37	4	
38	1	
39		
40	2	
41	2	
42	2	
43	1	
44	1	1
45		3
46		12
47		27
48		42
49		18
50		7
51		



Weekly proportions of coded-wire tagged spring and fall Chinook observed in the 2010 main stem Trinity River spawner survey.

Trinity River Hatchery Spring/Fall spawning break was Julian Week 41, for live fish passing through the weirs it was Julian Week 34.

Trinity River Carcass Survey

Analytical Methods

4. Coded Wire Tag (CWT) Analysis

- Percent hatchery contribution calculated by dividing estimated # hatchery fish (expanded total) by the total observed # of carcasses captured during each run. %Trinity River Hatchery spring = *(56.744/total SR)*100* = 5.64%

2010 Coded Wire Tag (CWT) Results estimating number of hatchery fish for each run

Release data					Recovery data				
			Release	Production	Recovery period$_3$				Expanded
CWT Code	Brood year	Age	type$_1$	multiplier$_2$	Spring	Fall	Total	% of subtotal	total
Spring Chinook									
65349	2006	4	Sf	4.13275	4		4	23.53	16.531
65360	2006	4	Sy	4.01047	7		7	41.18	28.073
68803	2007	3	Sf	4.09192	1		1	5.88	4.092
68810	2007	3	Sy	4.02374	1	1	2	11.76	8.047
No CWT recovered$_4$					3		3	17.65	
				Subtotal:	16	1	17	100.00	56.744

- Age- Structure expanded by summing all expanded totals for each year class, then divide that by total observed # of carcasses captured during each run. *Percent Age 3 (TRH) spring =(12.139/total SR)*100* = 1.21%

- Incidence of Straying inferred by observance of non-TRH CWT's being discovered

Analytical Methods

5. Percent Grilse calculated with grilse cutoff fork length from Trinity River Project weirs and hatchery data.

   %Grilse = (Number measured below grilse cutoff/Total measured)*100

   % Spring Chinook Grilse = (44 / 967) *100 = 4.56%

6. Assumptions used in the analyses and support for their validity (i.e.: direct testing of assumptions or other evidence that supports the validity of the assumptions)

   Mark-Recapture Model Assumptions (Modeled for **live** populations)

   - No marks are lost or missed
   - Equal Catchability
   - Random mixing of marked and unmarked individuals

   Pre-spawn Mortality is either yes or no

Project Reporting

1. Reporting of information
   - Four times throughout the year Quarterly Reports to the T.R.R.P. are submitted with preliminary reports of findings.

     (mid-January, April, July, and October)
   - Annual Reports to the T.R.R.P. are submitted with final summaries of all findings during the survey.
2. Data storage
   - Data is stored at the Weaverville office, Arcata Office, on the shared folder of the Redding Fish and Game office, and at the Arcata Fish and Wildlife Office.

Issues/Challenges/Feedback to TRRP

1.Explain any issues/challenges that have occurred and how these influence the ability of the project to meet its objectives.

- Weather, turbidity, visibility, holidays, and flows cause surveys to be periodically delayed or cancelled.
- Loss of carcasses due to predation and decay.
- Loss of satellites for electronic data recording

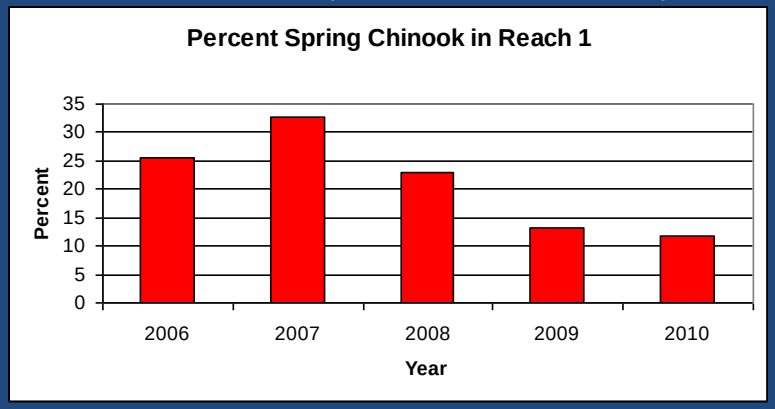
2.Present what we have learned from implementing this project (eve preliminary analyses) in assessing the effectiveness of the TRRP.

- Pre-spawn mortality rates range from 1.1% to 44.9% (1988), not below 10% since 1995.
- No incidences of hatchery straying by CWT analysis has occurred to the Trinity River in past six years.

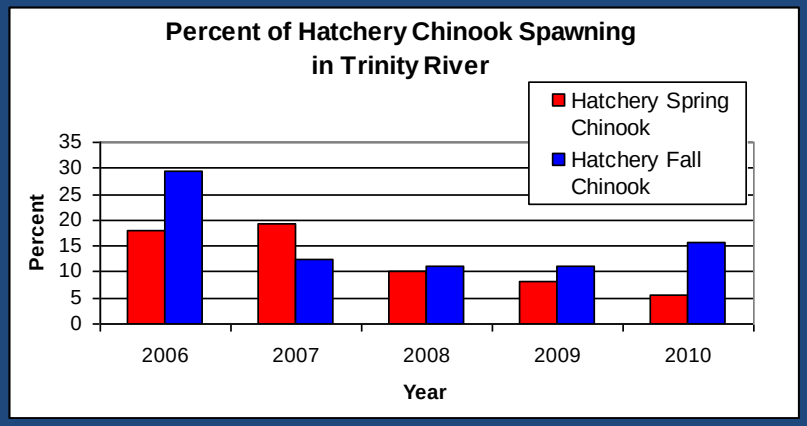
Issues/Challenges/Feedback to TRRP

2. Present what we have learned from implementing this project in assessing the effectiveness of the TRRP.

- A trend of decreased spring Chinook carcasses recovered in the uppermost reach below Trinity River Hatchery since 2006.



- Trend of decreased numbers of hatchery fish spawning in the river

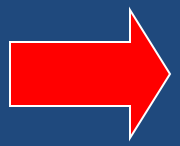


Issues/Challenges/Feedback to TRRP

3. How does this information relate to evaluating and/or recommending management actions (linking back to information presented in slide #4)

Recommended Management Action #1

Flows not reduced in October.



Right after most spring Chinook have finished spawning, the October flows are reduced from 450cfs to 300 cfs reducing flow in river and altering flow in the side-channels.

Recommended Management Action #2

100% mass marking of hatchery fish to better enumerate hatchery contribution to the fishery. All states except California do mass marking of spring Chinook.

Redd survey

U.S. Fish & Wildlife Service
Yurok Tribal Fisheries Program
California Department of Fish & Game
Shasta Trinity National Forest
Hoopa Valley Tribal Fisheries Department

Presented by
Charles Chamberlain

Trinity River Restoration Program

Adult Monitoring Evaluation Workshop

October 26-27, 2011

Project Background

Redd counts by reach

Redds locations recorded with linear distance (river kilometer)

Redd locations recorded via GPS

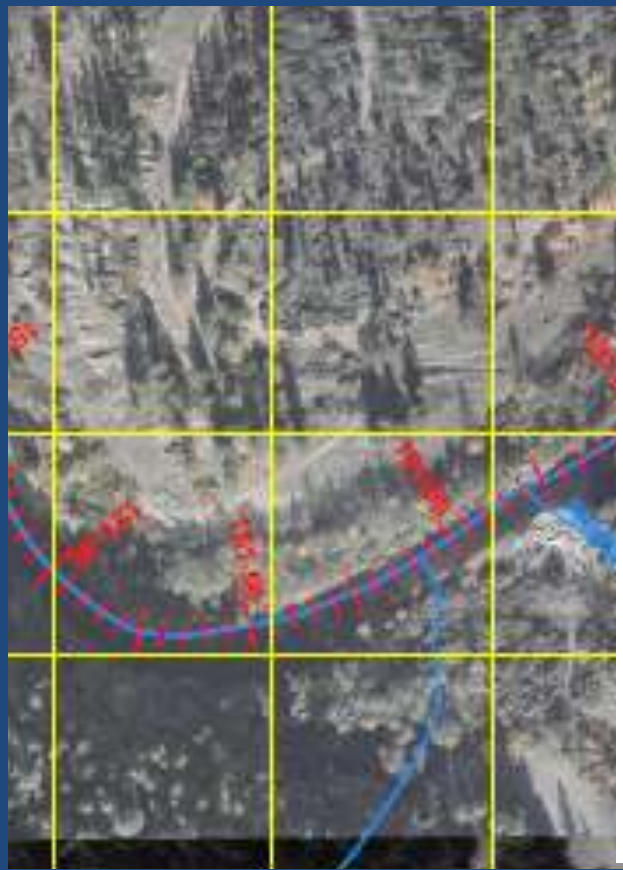
Project Background

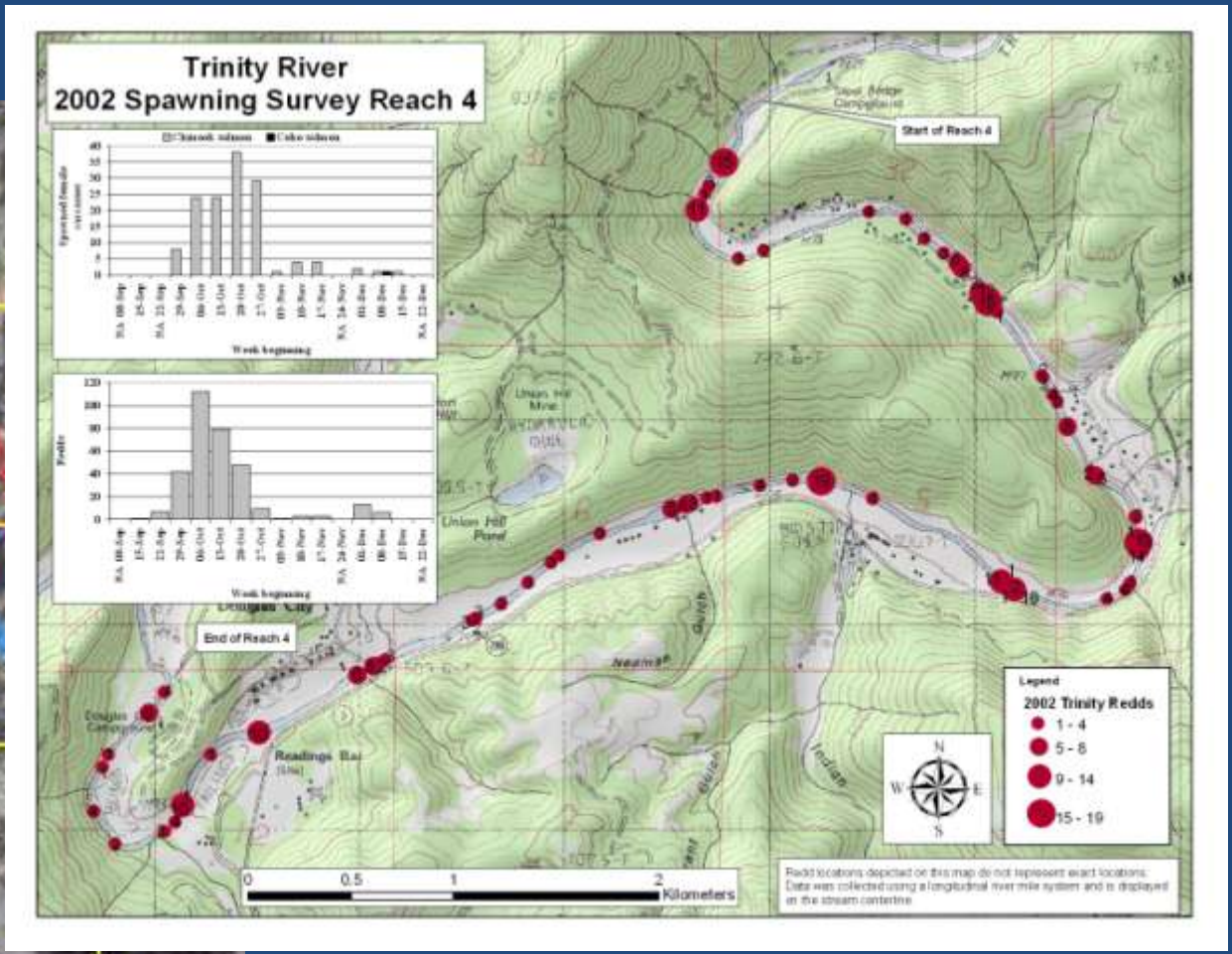
Redds locations recorded with linear distance (river kilometer)

Redd locations recorded via GPS

Project Background

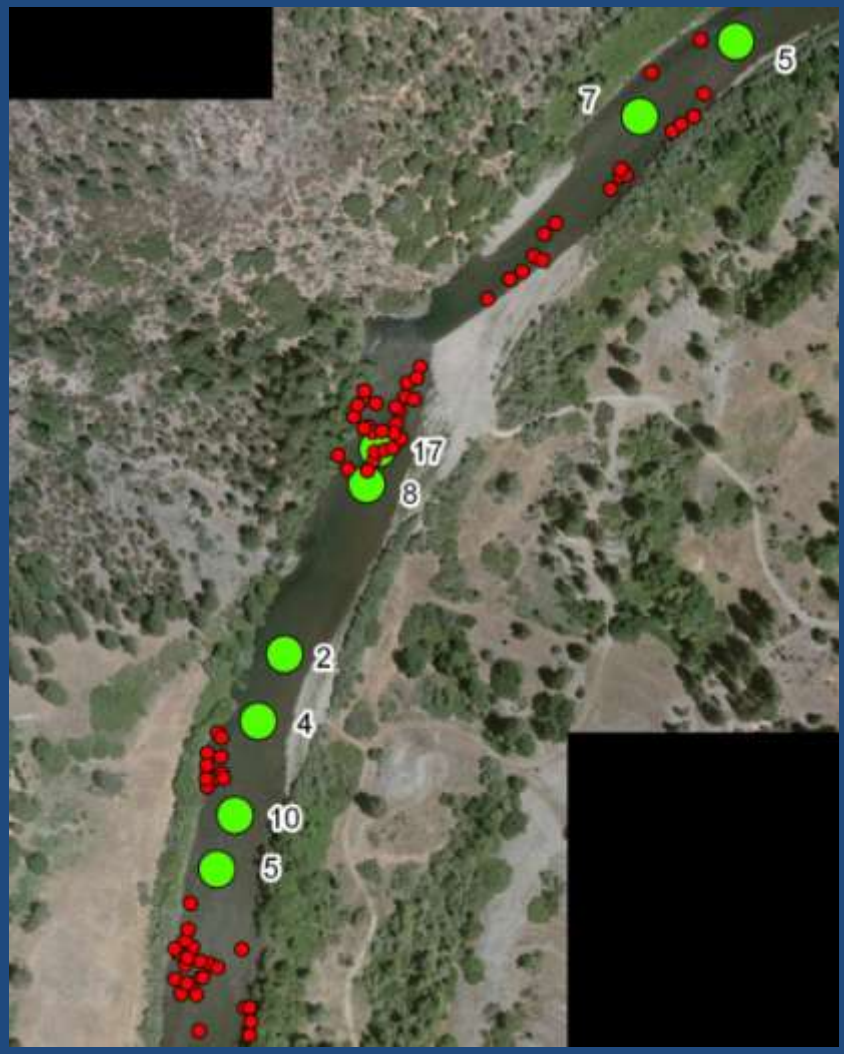
- Aerial photo based methods 2002 to 2008 (linear spatial reference)





Project Background

- GPS based methods 2009 to present



Project Objectives

– Assess the spatial distribution of Chinook salmon redds, monitor for response to TRRP management actions.

Project Objectives

- Assess the spatial distribution of Chinook salmon redds, monitor for response to TRRP management actions.
- Quantify and describe temporal and spatial distribution of natural and hatchery origin Chinook salmon spawning.

How does this project support the Trinity River Restoration Program?

How does this project support the Trinity River Restoration Program?

Numbers

How does this project support the Trinity River Restoration Program?

Numbers

Response to changes in distribution of spawning habitat

How does this project support the Trinity River Restoration Program?

Numbers

Response to changes in distribution of spawning habitat

Response to distribution of rearing habitat

How does this project support the Trinity River Restoration Program?

Numbers

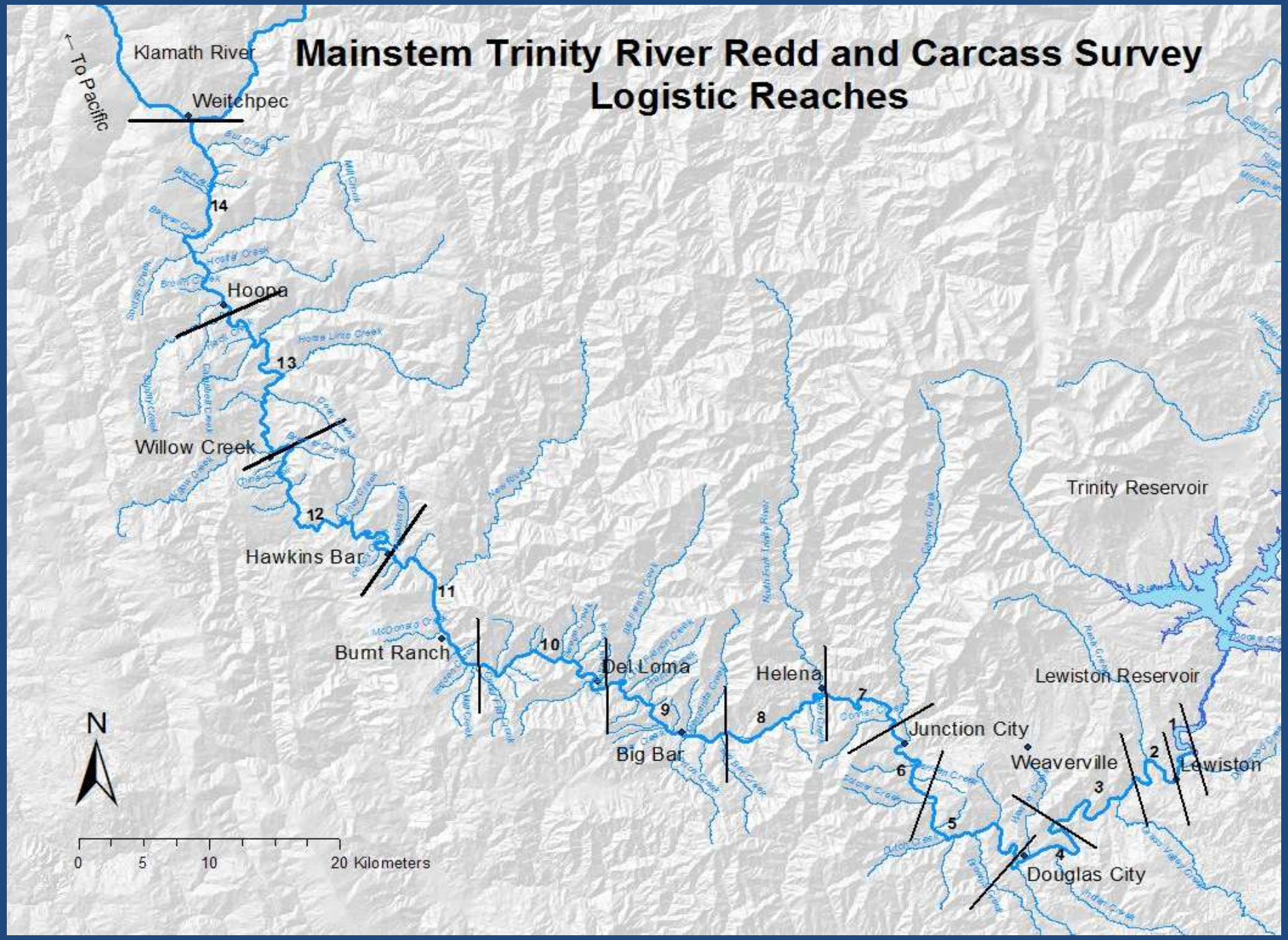
Response to changes in distribution of spawning habitat

Response to distribution of rearing habitat

Response to hatchery influence

Field Methods

1. Raft-based surveys. A crew of 2 on each side of the river.
2. Redds locations are recorded with GPS


Mainstem Trinity River Redd and Carcass Survey
Logistic Reaches
← To Pacific
Klamath River
Weitchpec
14
Hoopa
13
Willow Creek
12
Hawkins Bar
11
Burnt Ranch
10
Del Loma
9
Big Bar
8
Helena
7
Junction City
6
5
Douglas City
4
3
Weaverville
2
Lewiston
1
Lewiston Reservoir
Trinity Reservoir
N
0
5
10
20 Kilometers

Analytical Methods

1. Data management, QA/QC procedures
    a) Tablet PC collected

Analytical Methods

1. Data management, QA/QC procedures
    a) Tablet PC collected
    b) Suspected duplicates or “strays” are removed

Analytical Methods

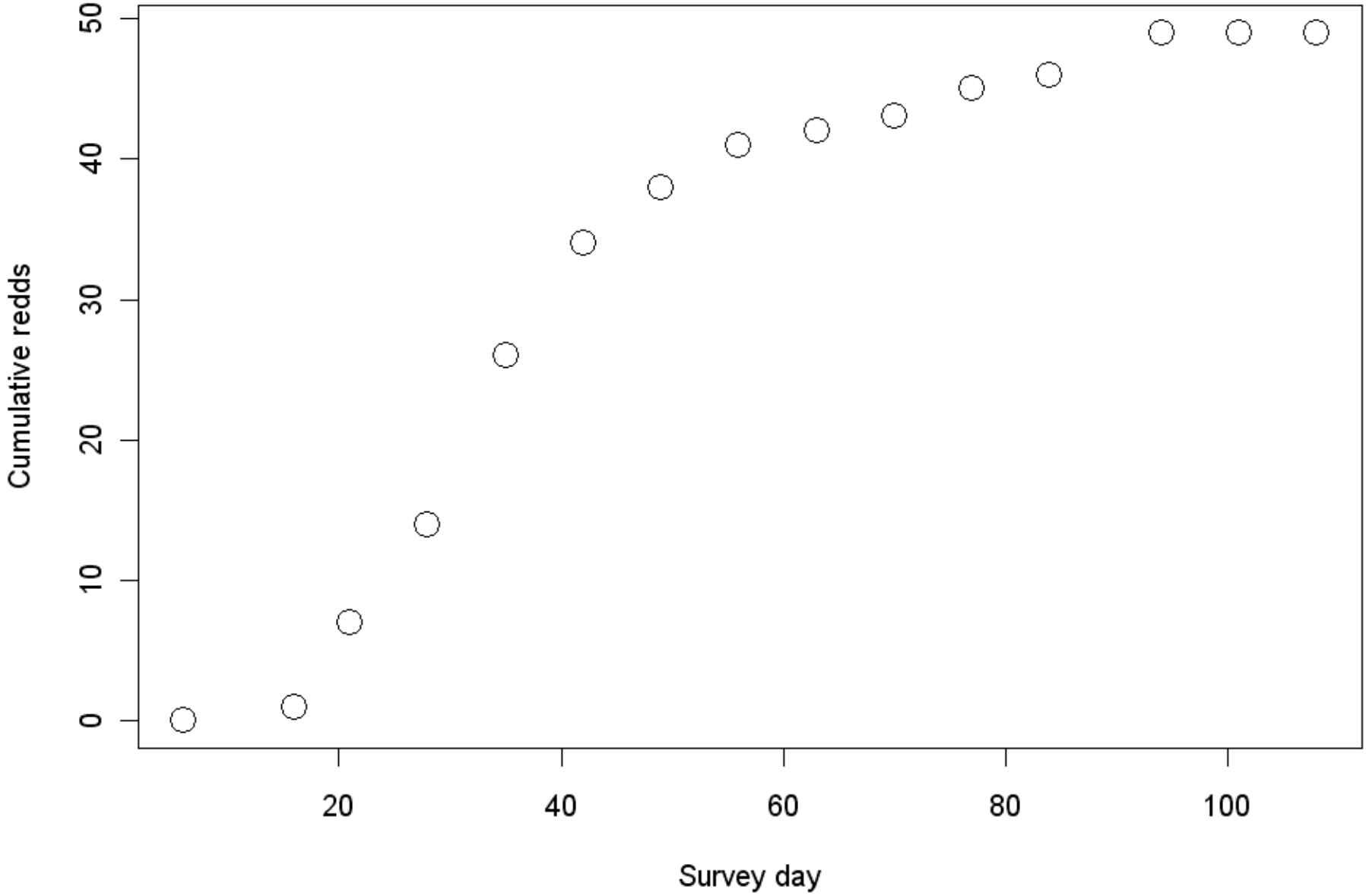
2. Data analyses (estimation methods)
    a. “Census” of redds (all salmon), each marked with xy

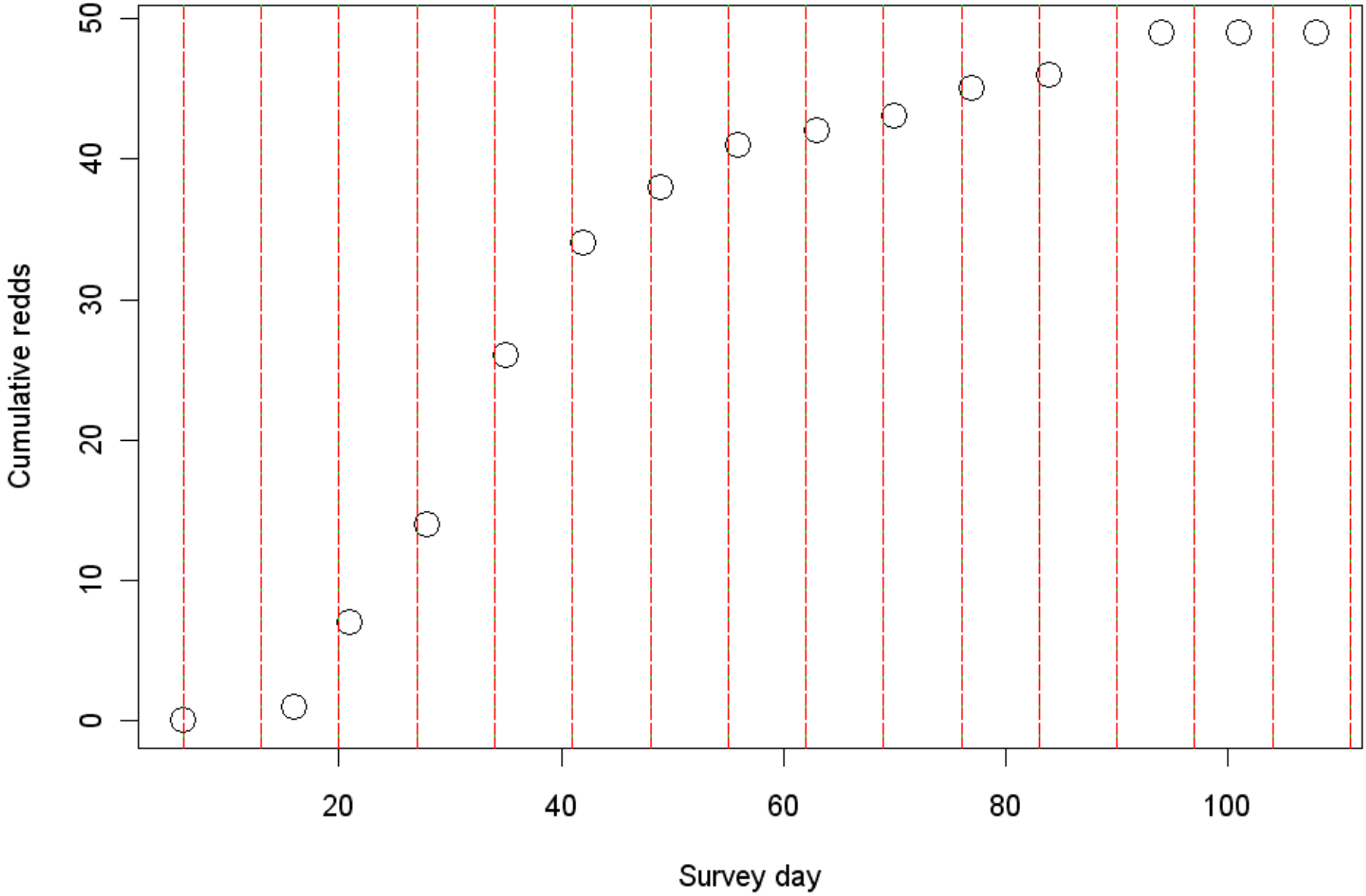
Analytical Methods

2. Data analyses (estimation methods)
   a. "Census" of redds (all salmon), each marked with xy
   b. Locations snapped to river centerline for linear reference

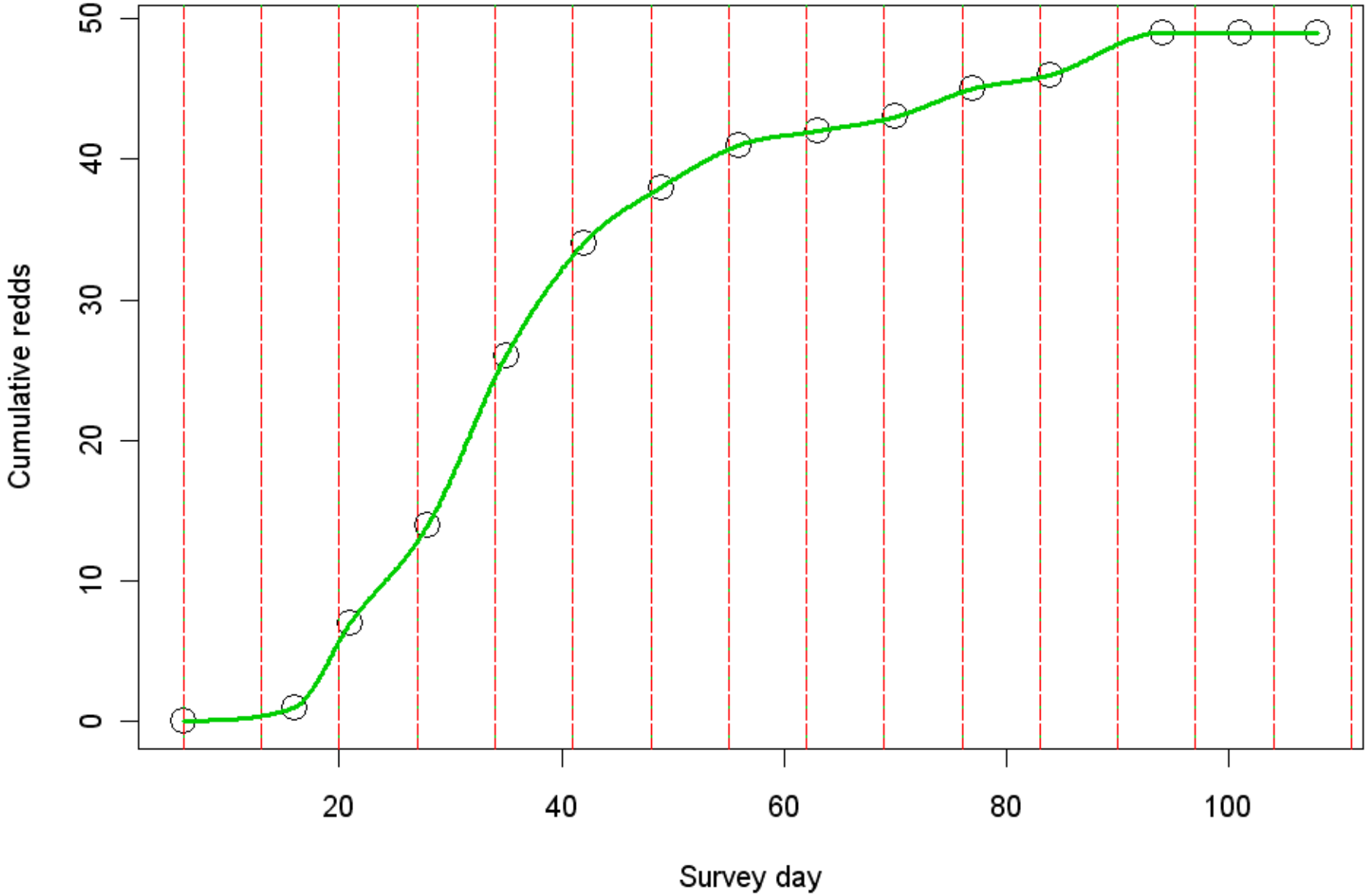
Analytical Methods

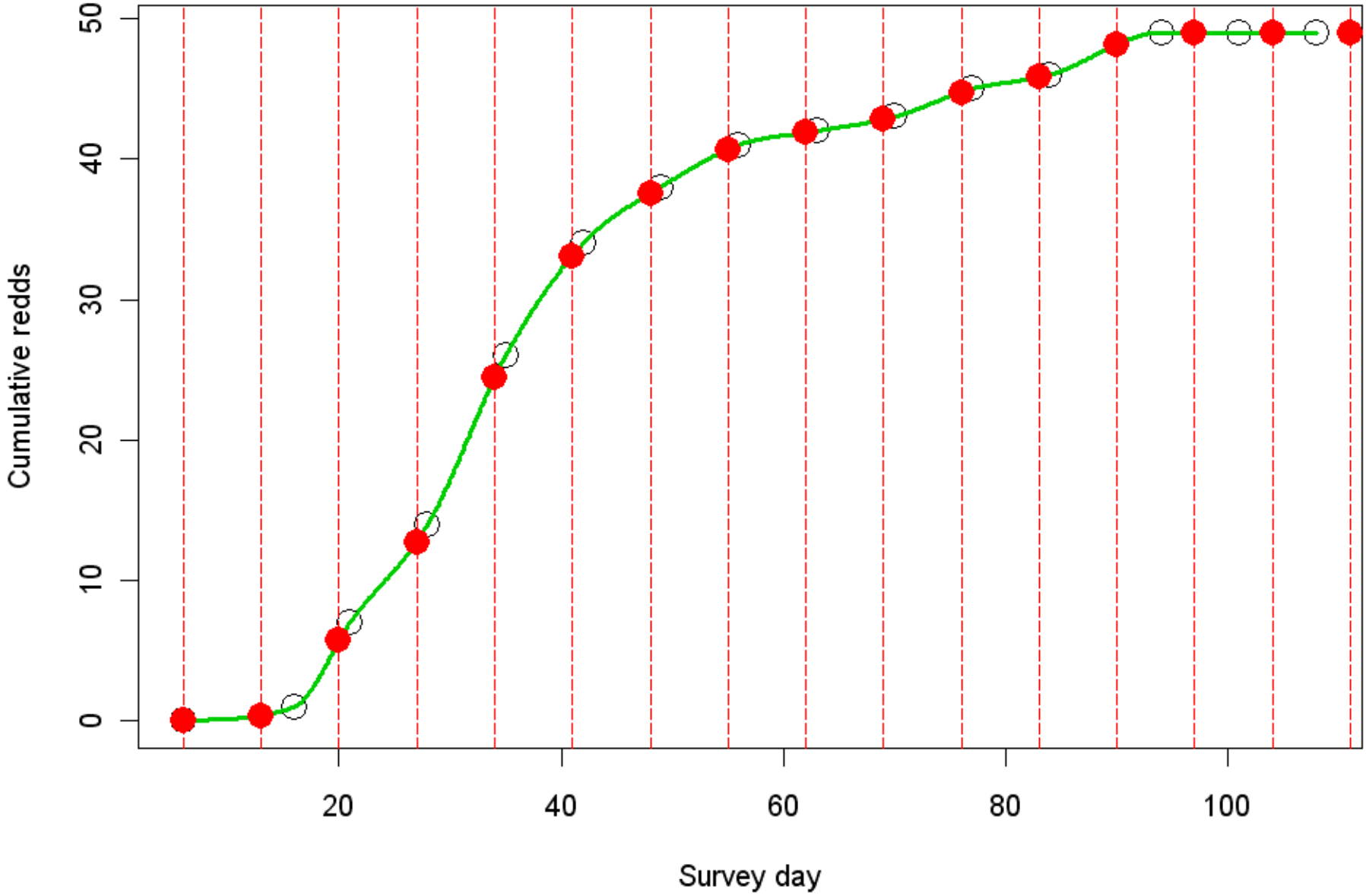
2. Data analyses (estimation methods)
   a. "Census" of redds (all salmon), each marked with xy
   b. Locations snapped to river centerline for linear reference
   c. Data arranged cumulatively by bin and spline interpolated.


Cumulative redds
0
10
20
30
40
50
20
40
60
80
100
Survey day

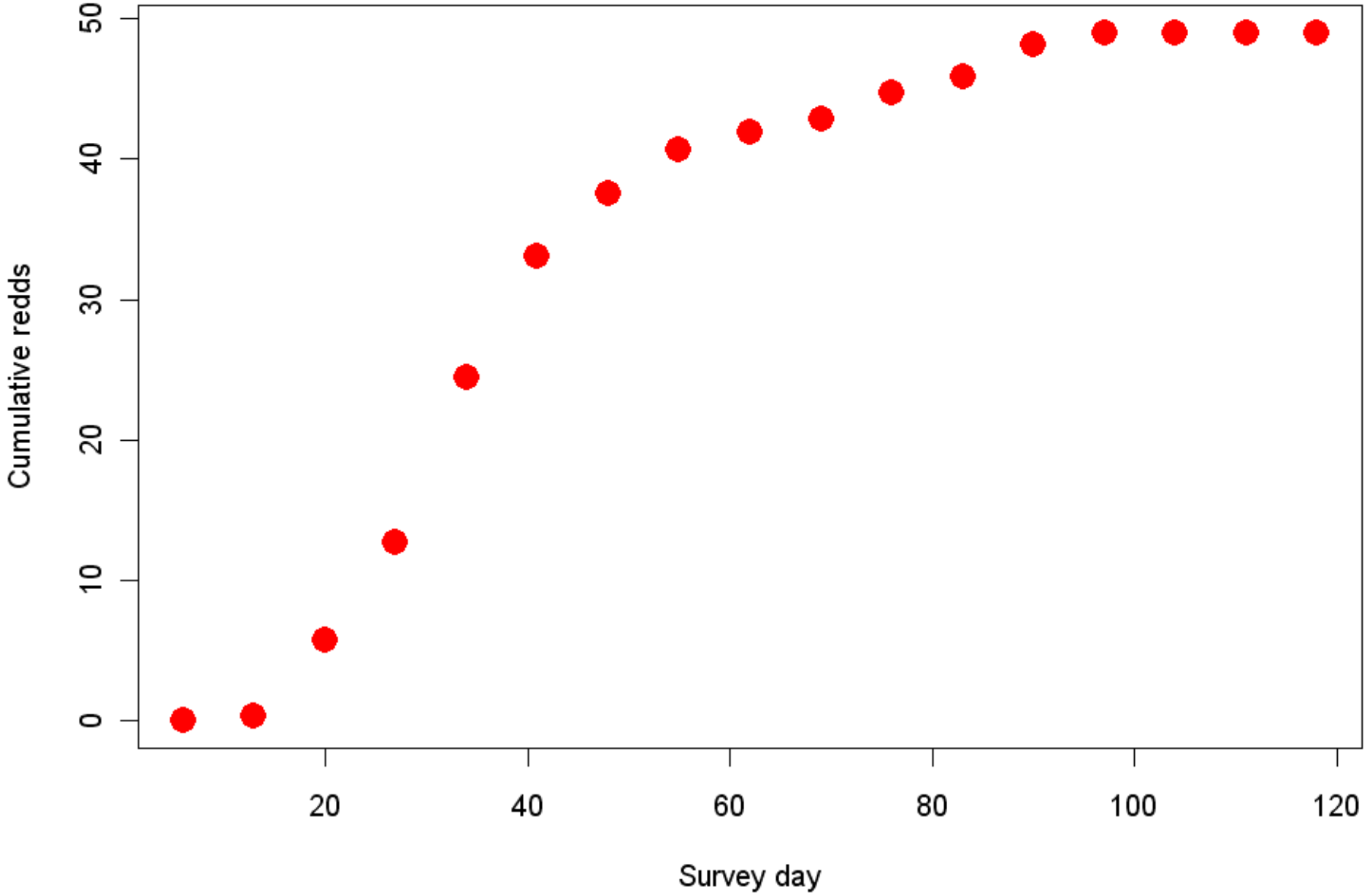

Cumulative redds
0
10
20
30
40
50
20
40
60
80
100
Survey day

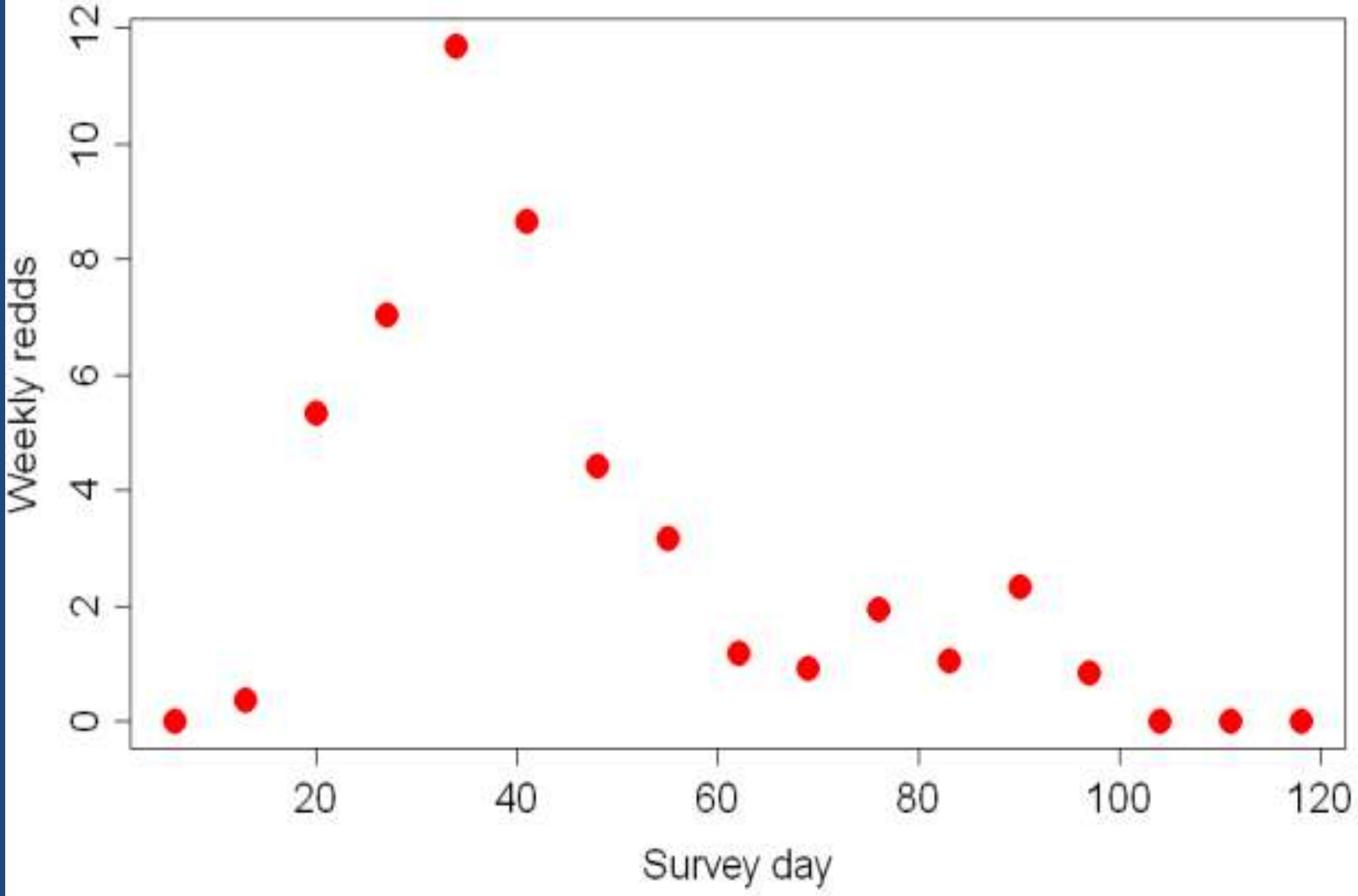
Fit monotonic cubic Hermite spline to observed data

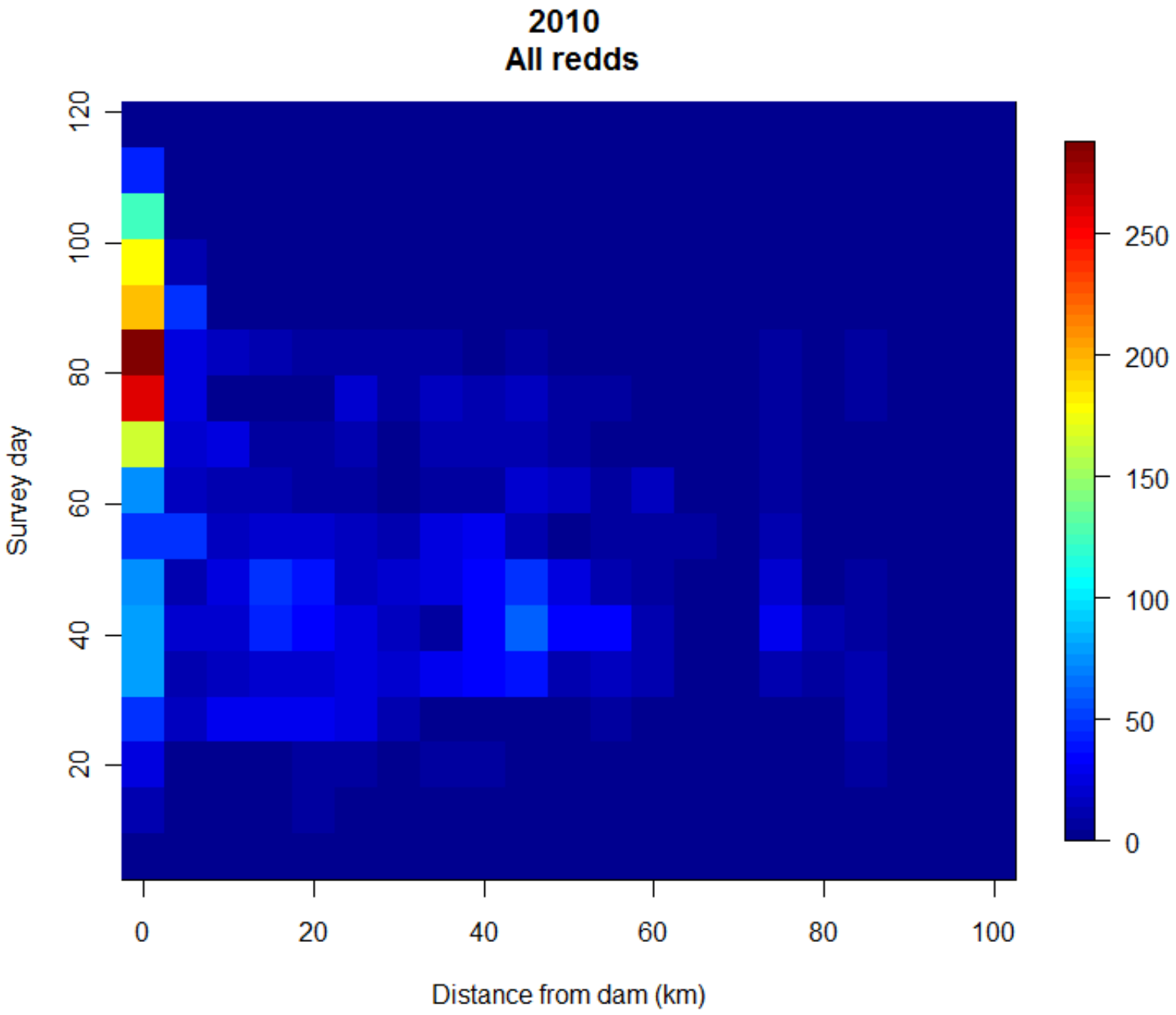



Cumulative redds
0
10
20
30
40
50
20
40
60
80
100
Survey day

Spline-fit points at weekly intervals




Weekly redds
0
2
4
6
8
10
12
20
40
60
80
100
120
Survey day


2010
All redds
Survey day
120
100
80
60
40
20
0
20
40
60
80
100
Distance from dam (km)
250
200
150
100
50
0

Analytical Methods

2. Data analyses (estimation methods)
   a. "Census" of redds (all salmon), each marked with xy
   b. Locations snapped to river centerline for linear reference
   c. Data arranged cumulatively by bin and spline interpolated.
   d. Distribution of spawned female carcasses modeled (GAM) to estimate proportion constructed by species (Chinook vs. coho) and origin (hatchery vs. natural)

Generalized additive model

$$\hat{p} \sim s(DFD, 3) + s(Survey\ Day, 3)$$

Where $\hat{p}$ = Estimated proportion of species/mark condition of interest

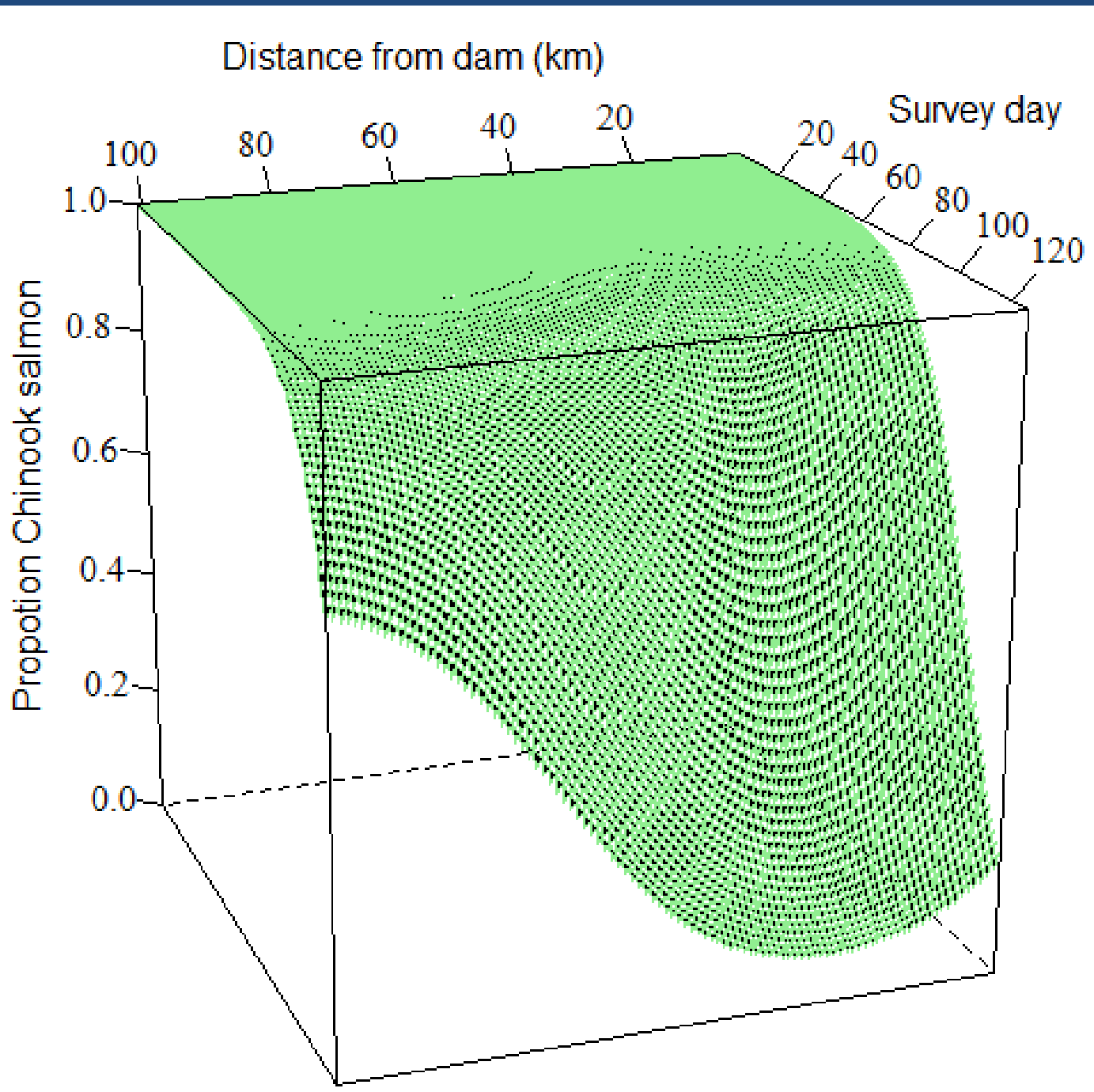
$s(DFD, 3)$ = Distance from Lewiston Dam in kilometers (spline smoothed with 3 df)

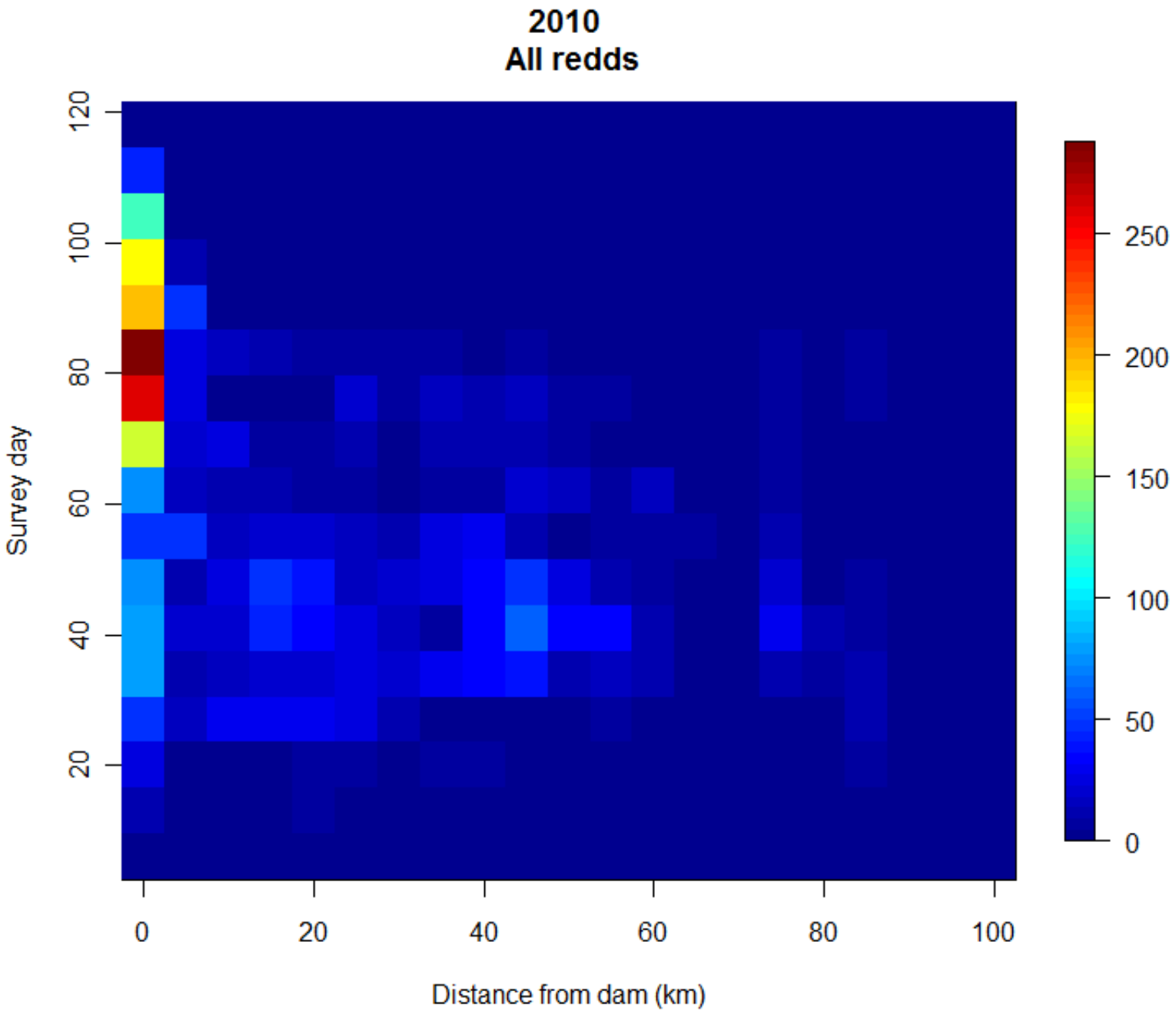
$s(Survey\ Day, 3)$ = Day of survey (spline smoothed with 3 df)

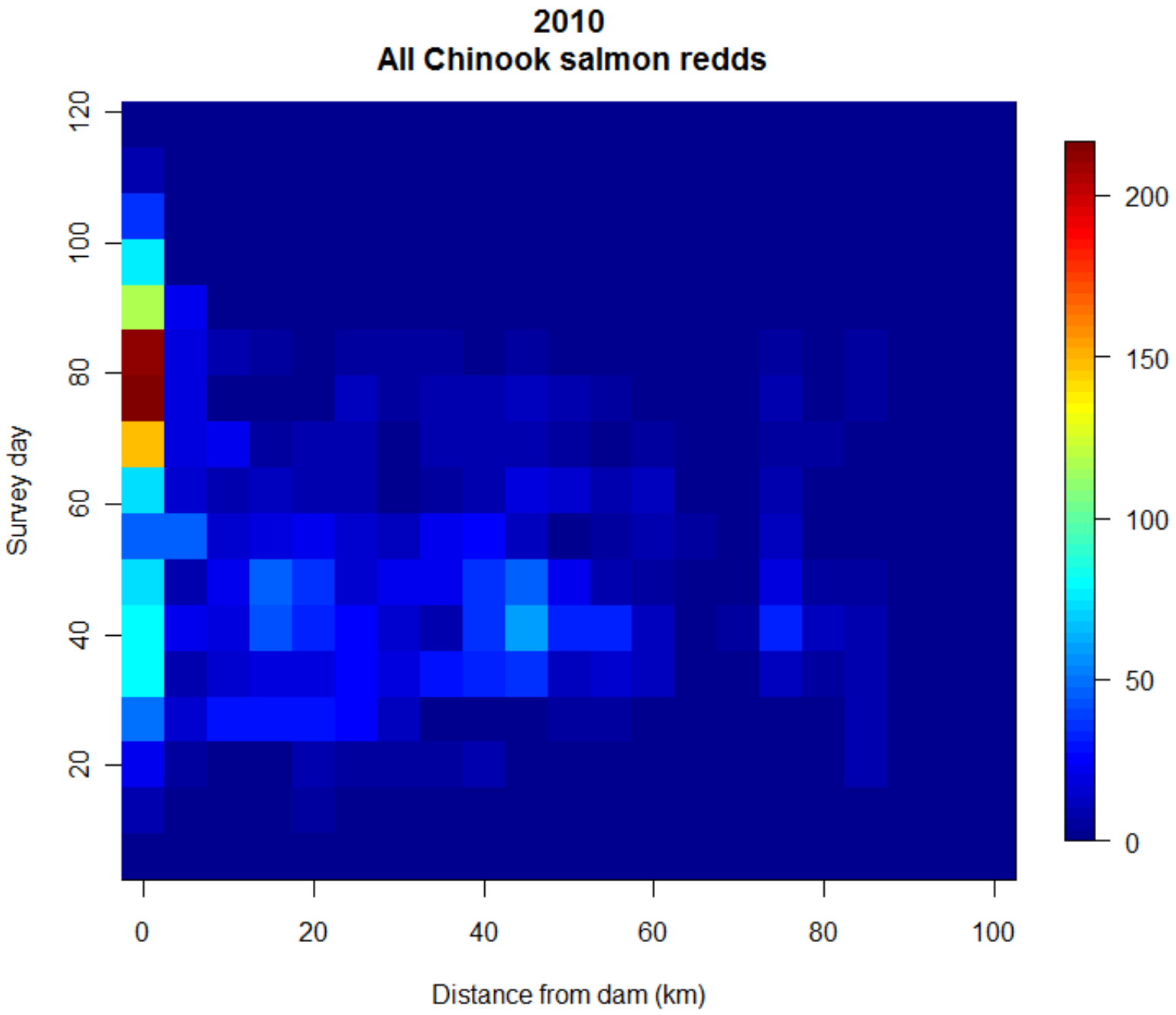
$$\text{Chinook redd multiplier} = \frac{\hat{p}_{\text{Chinook female}}}{\hat{p}_{\text{Chinook female}} + \left(\hat{p}_{\text{coho female}} \times 1.25\ \text{coho redds}/\text{female}\right)}$$

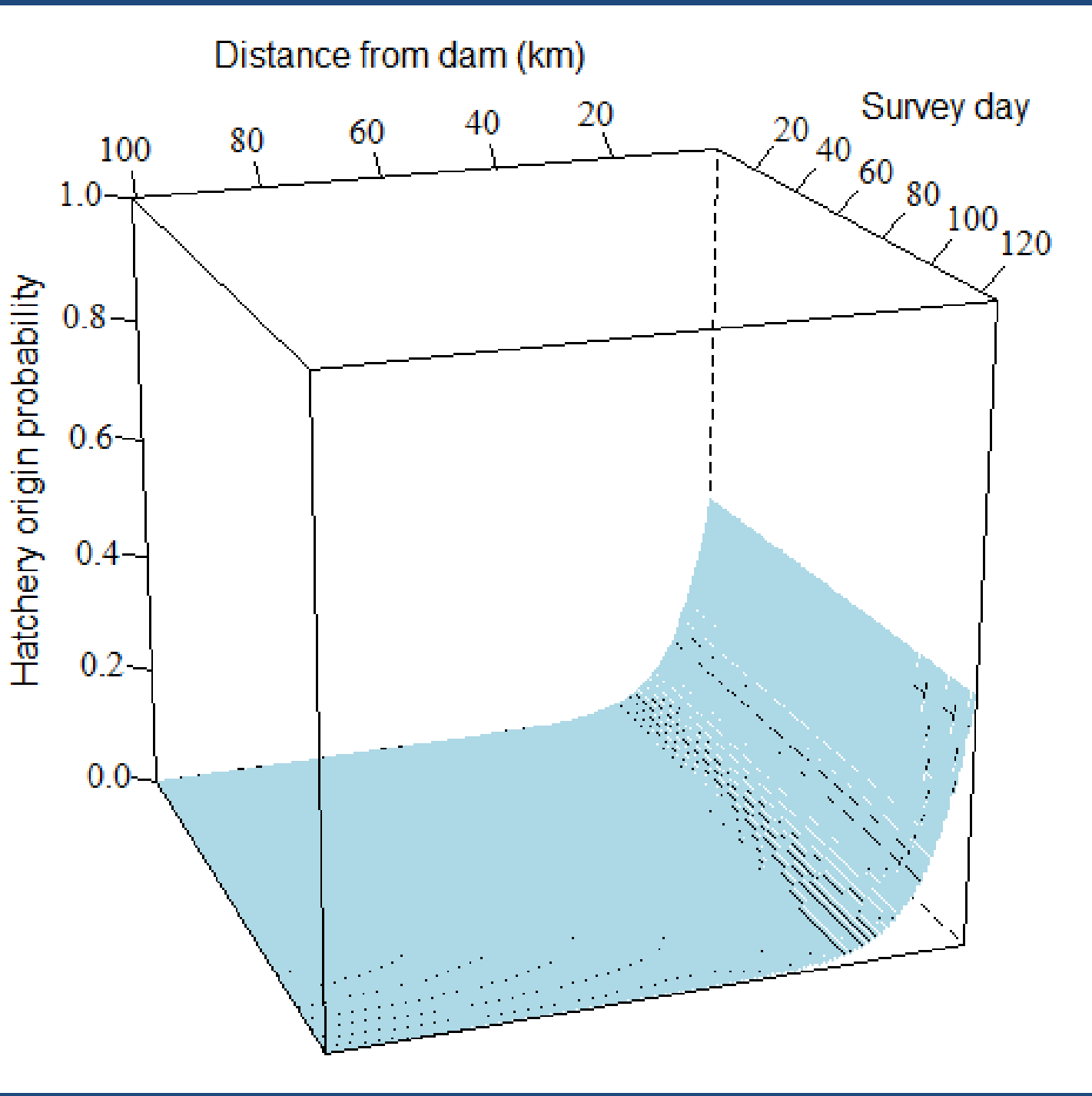
Where ($\hat{p}$) = Proportions estimated from GAM model output

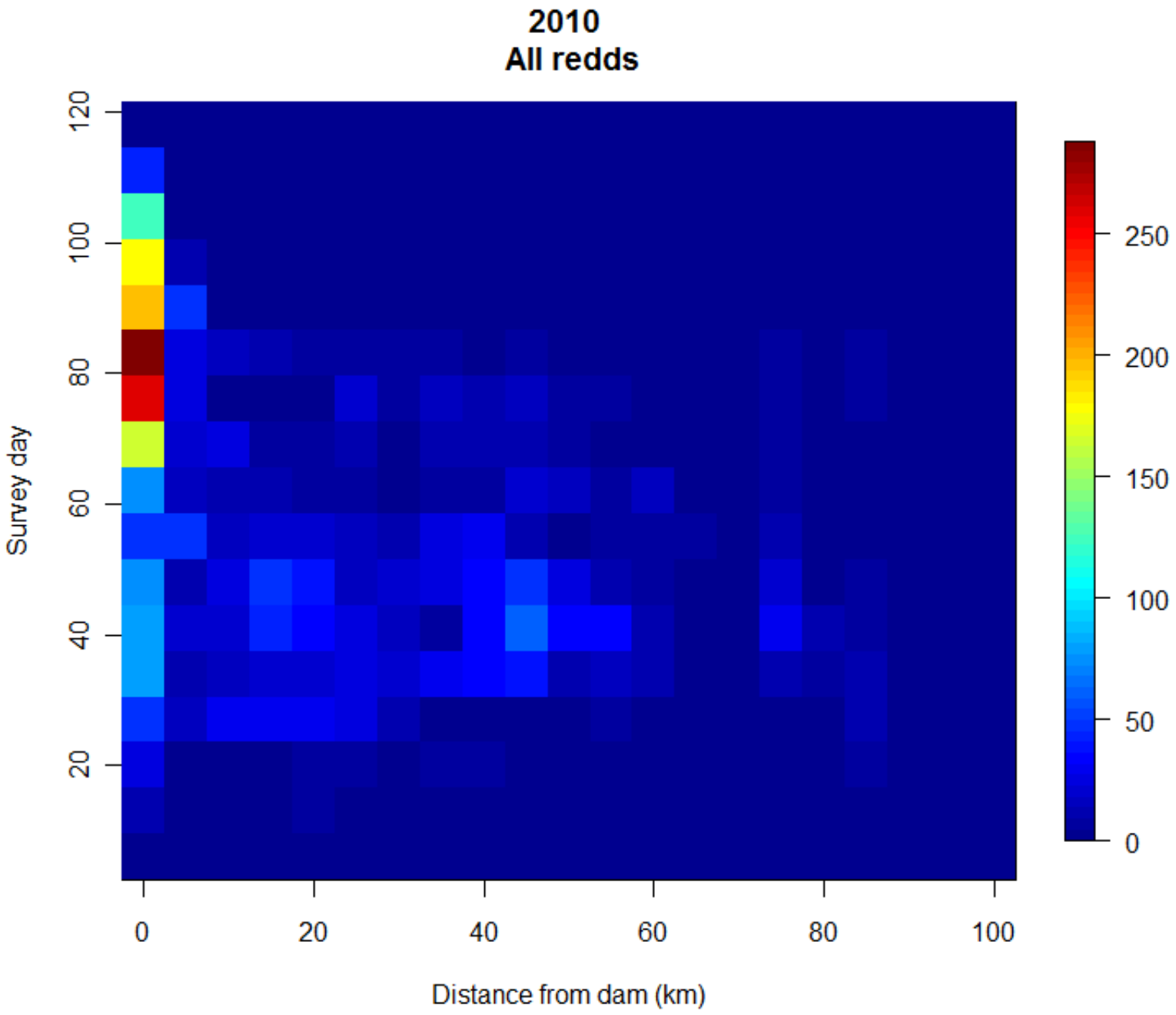
(Duffy 2005)

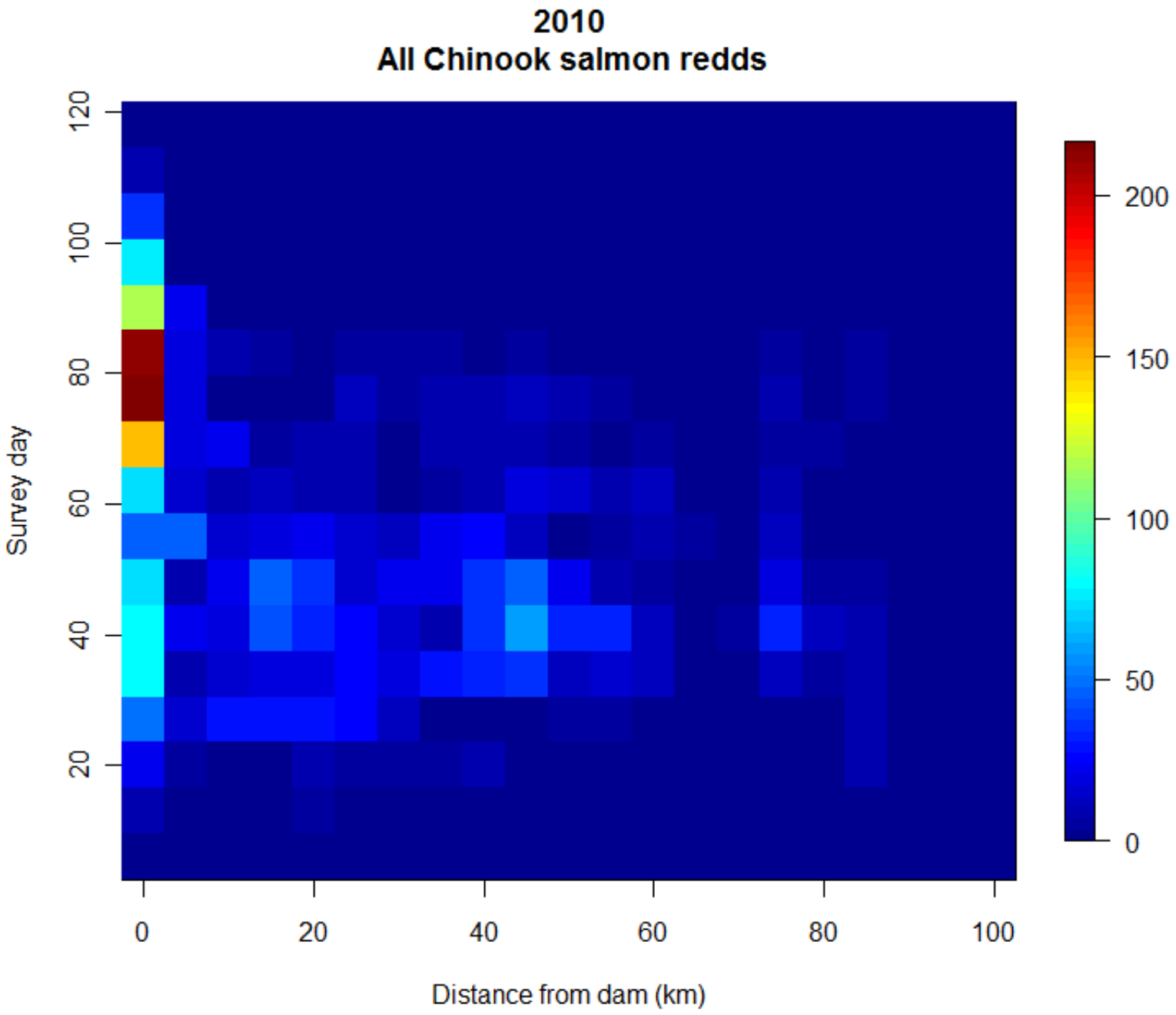

Distance from dam (km)
100
80
60
40
20
Survey day
20
40
60
80
100
120
Propotion Chinook salmon
1.0
0.8
0.6
0.4
0.2
0.0

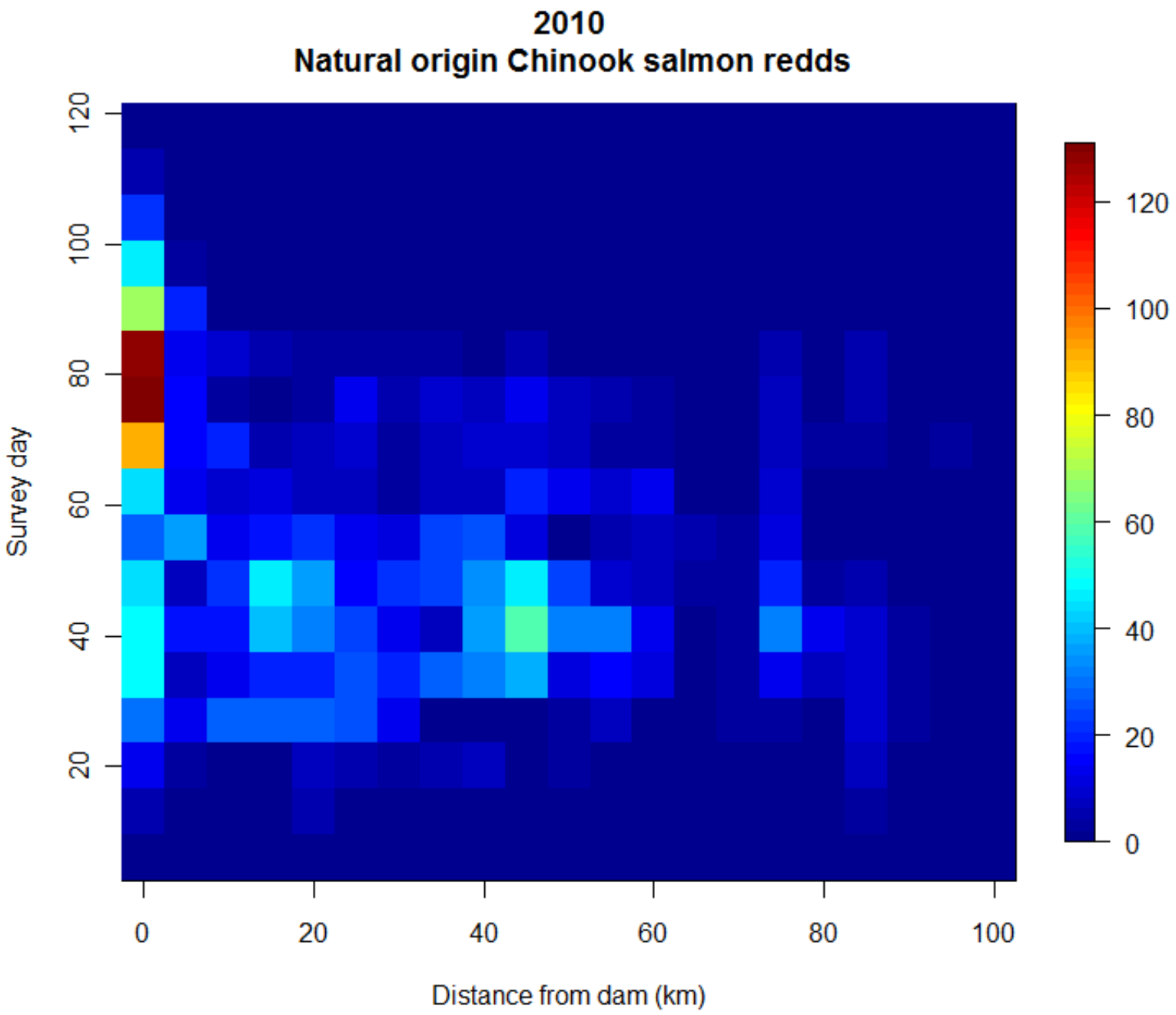

2010
All redds
Survey day
120
100
80
60
40
20
0
20
40
60
80
100
Distance from dam (km)
250
200
150
100
50
0

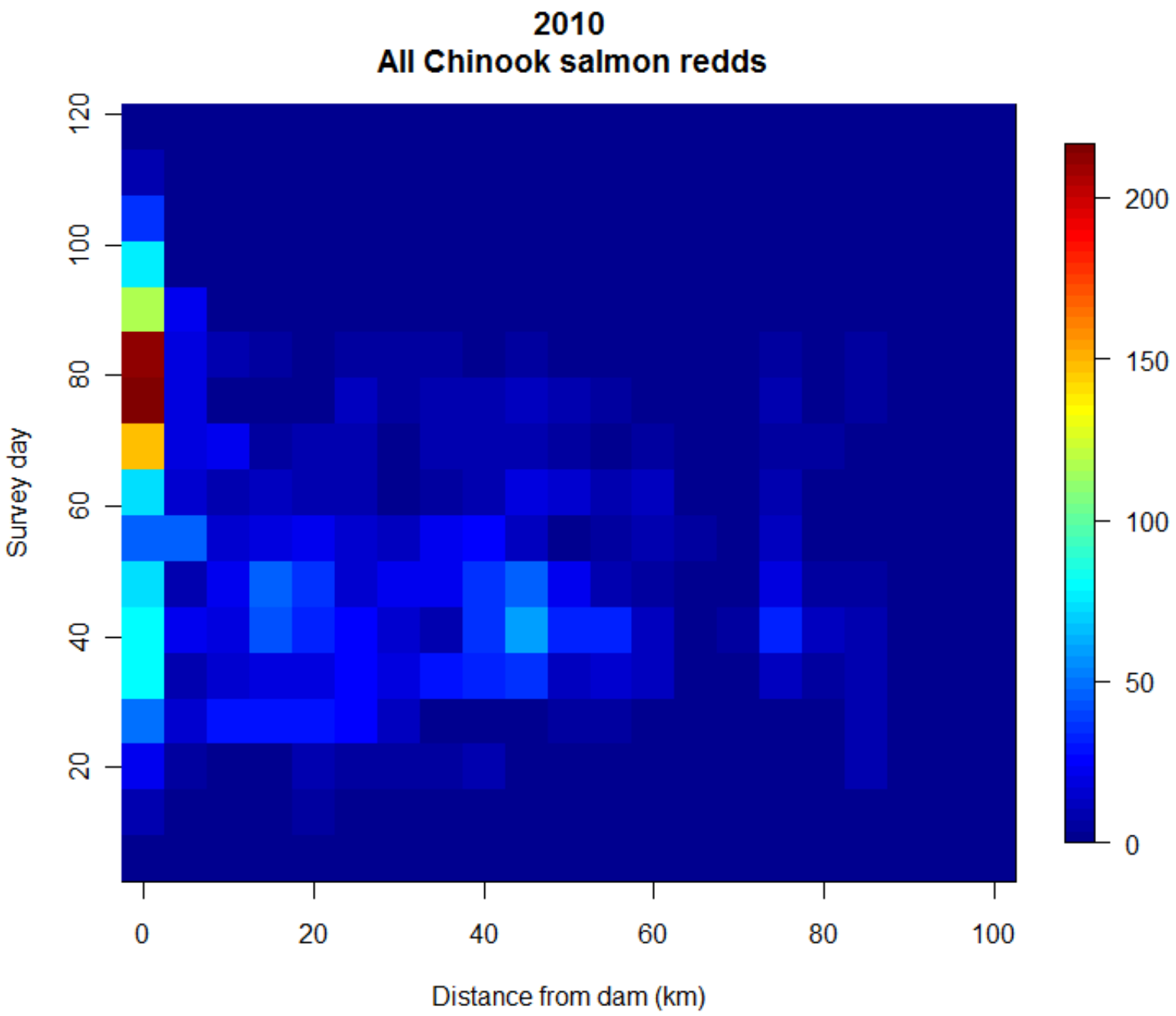

2010
All Chinook salmon redds
Survey day
120
100
80
60
40
20
0
20
40
60
80
100
Distance from dam (km)
200
150
100
50
0

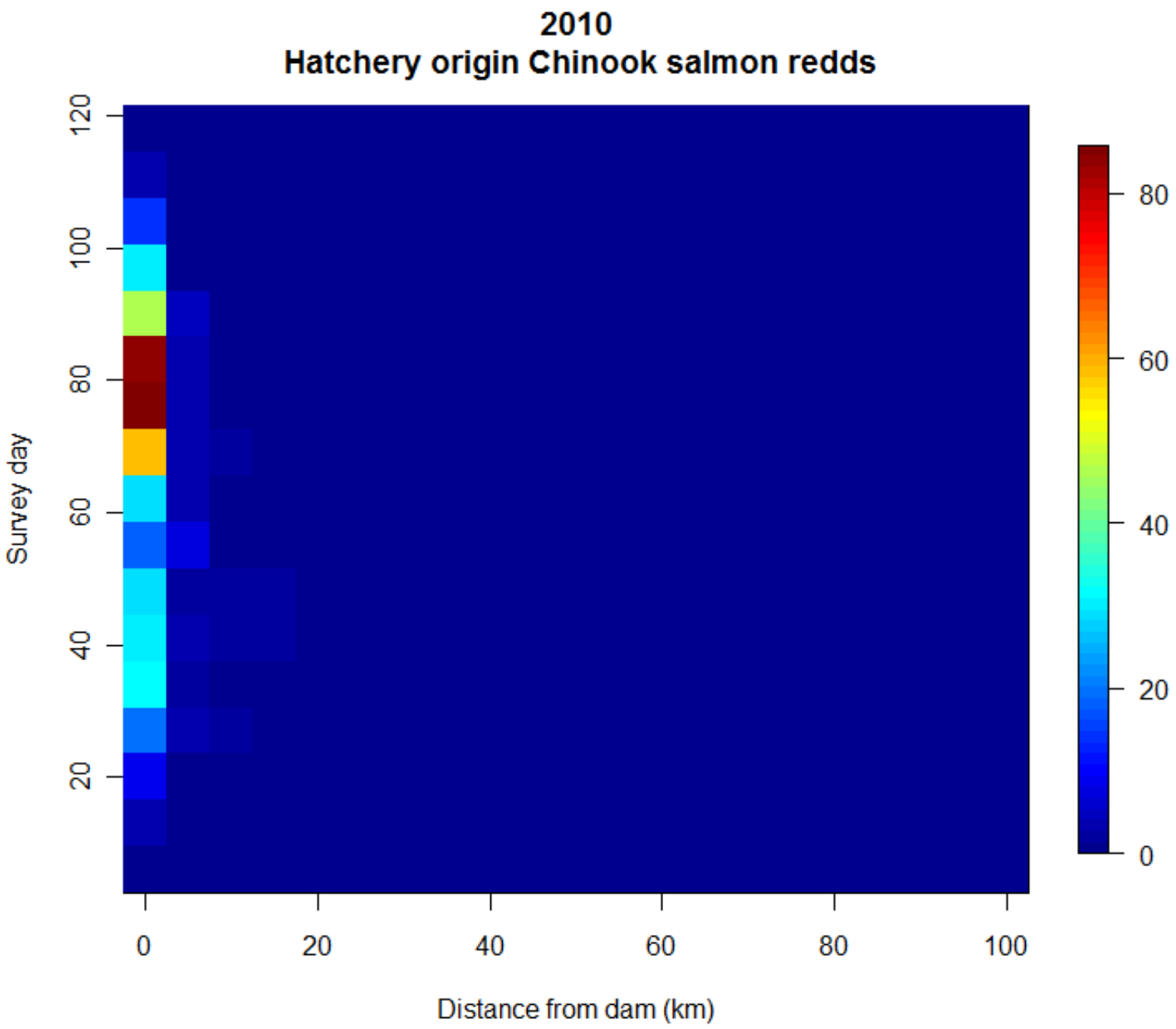

Distance from dam (km)
100
80
60
40
20
Survey day
20
40
60
80
100
120
Hatchery origin probability
1.0
0.8
0.6
0.4
0.2
0.0


2010
All redds
Survey day
120
100
80
60
40
20
0
20
40
60
80
100
Distance from dam (km)
250
200
150
100
50
0


2010
All Chinook salmon redds
Survey day
120
100
80
60
40
20
0
20
40
60
80
100
Distance from dam (km)
200
150
100
50
0


2010
Natural origin Chinook salmon redds
Survey day
120
100
80
60
40
20
0
20
40
60
80
100
Distance from dam (km)
120
100
80
60
40
20
0


2010
All Chinook salmon redds
Survey day
120
100
80
60
40
20
0
20
40
60
80
100
Distance from dam (km)
200
150
100
50
0


2010
Hatchery origin Chinook salmon redds
Survey day
120
100
80
60
40
20
0
20
40
60
80
100
Distance from dam (km)
80
60
40
20
0

Analytical Methods

2. Data analyses (estimation methods)
   a. "Census" of redds (all salmon), each marked with xy
   b. Locations snapped to river centerline for linear reference
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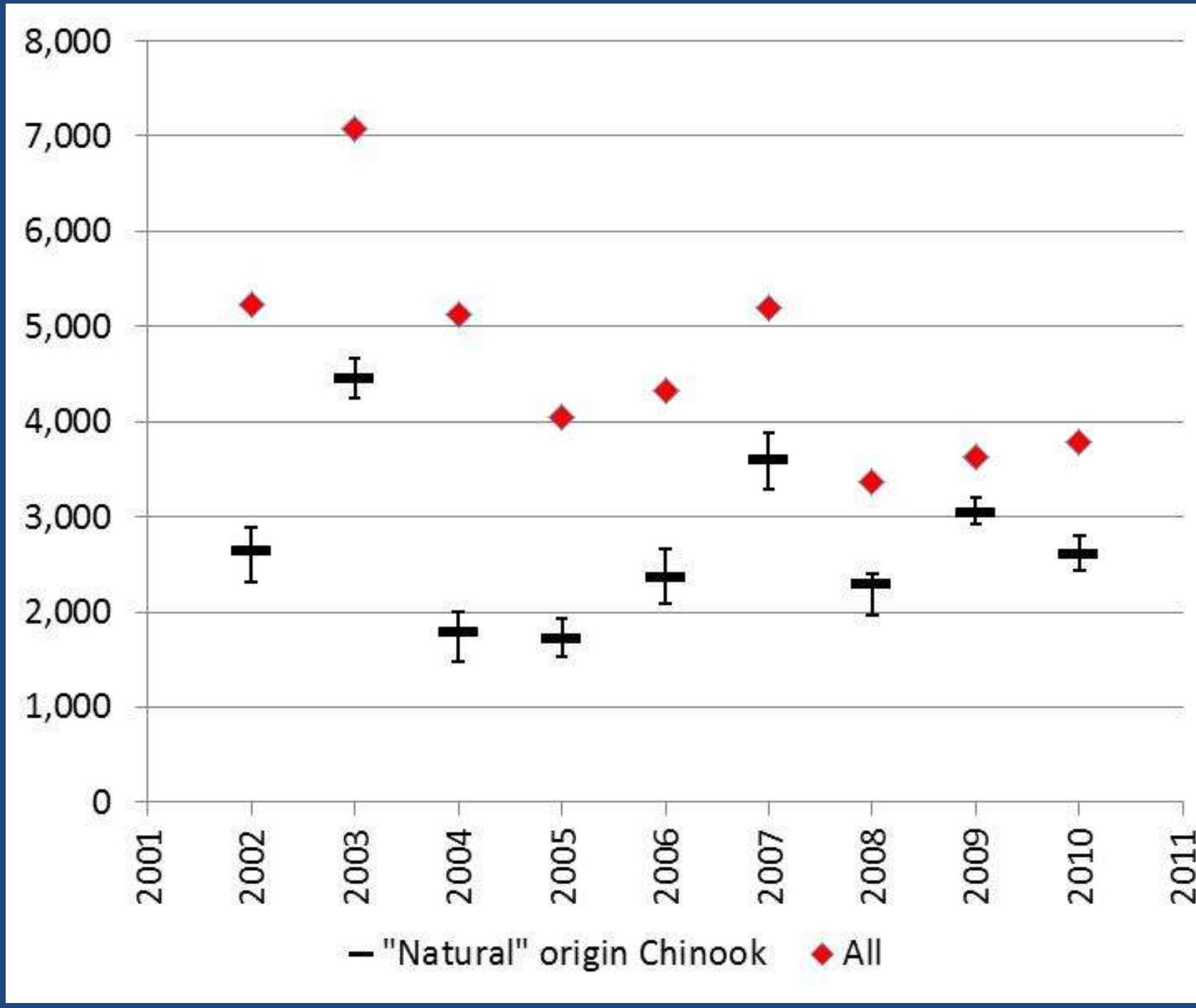
   d. Distribution of spawned female carcasses modeled (GAM) to estimate proportion constructed by species (Chinook vs. coho) and origin (hatchery vs. natural)
   e. Employ a bootstrap routine to generate confidence intervals for number of "natural" Chinook salmon redds (2.5 and 97.5 percentiles from 1,000 replicates)


8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
"Natural" origin Chinook
All

Analytical Methods

3. Assumptions used in the analyses
   a) Every redd is marked and marked only once

Analytical Methods

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   a) Every redd is marked and marked only once
   b) 14 days between appearance of redd and availability of the female that constructed it to recovery in our carcass survey

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   b) 14 days between appearance of redd and availability of the female that constructed it to recovery in our carcass survey
   c) ‘Drift’ is not significant enough to warrant a spatial offset (Glock et al 1980, Cederholm et al 1989, Riggers et al 1999, Murdoch et al 2009b, our data)

Analytical Methods

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   c) 'Drift' is not significant enough to warrant a spatial offset (Glock et al 1980, Cederholm et al 1989, Riggers et al 1999, Murdoch et al 2009b, our data)
   d) Coho salmon build 1.25 redds per female, Chinook 1 redd per female (Duffy 2005)

Project Reporting

1. Reporting of information
    a) Final edits/response to reviewer comments in progress for 2002 to 2010 report.

Project Reporting

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   d) In-season reports are posted weekly

In-season reports posted weekly
www.fws.gov/arcata/fisheries

U.S. Fish & Wildlife Service

Arcata Fish & Wildlife Office Fisheries Program

Trinity River mainstem redd survey update

10/24/2011

The Arcata Fish and Wildlife Office along with the California Department of Fish and Game, Yurok Tribal Fisheries Program, Hoopa Valley Tribal Fisheries Department, and Shasta-Trinity National Forest survey the mainstem Trinity River to recover salmonid carcasses and count and map Chinook salmon (*Oncorhynchus tshawytscha*) redds. The distribution of Chinook salmon redds is expected to change in response to rehabilitation efforts of the Trinity River Restoration Program, and the relative run size of natural vs. Trinity River Hatchery origin fish. Redd and carcass surveys are conducted weekly on the River between Lewiston Dam and the North Fork Trinity River (Reaches 1 through 7), and are conducted every other week on the Reaches downstream of the North Fork Trinity River (link to map).

This update provides preliminary data on 2011 redd counts encountered and entered into our database as of 10/21/2011 (Table 1). Figure 1 compares preliminary 2011 cumulative redd counts for Reaches 1-10 with the previous 9 years (2002-2010). Redds constructed by Chinook and coho salmon are not differentiated. Numbers are later adjusted for Chinook salmon of hatchery and natural origin using data provided by California Department of Fish and Game.

Table 1. Preliminary count of redds by logistic reach for the fall 2011 mainstem Trinity River redd survey. "NS" = not surveyed. Reach 11 not surveyed due to extreme whitewater (Burnt Ranch Gorge). These data are preliminary and subject to revision.

Week	Reach														
start	01	02	03	04	05	06	07	08	09	10	11	12	13	14	Total
9/12	8	0	0	3	8	0	0	0	0	0					19
9/19	23	27	39	30	30	1	0								150
9/26	68	33	48	52	91	8	10	2	3	2					317
10/3	167	36	67	92	57	27	28	4	5	15		NS	NS	NS	498
10/10	70	101	40	44	53	87	51	NS	120	84					650
10/17	158	64	56	28	151	105	113					14	0	0	689
10/24															0
10/31															0
11/7															0
11/14															0
11/21															0
11/28															0
12/5															0
12/12															0
12/19															0
Total	494	261	250	249	390	228	202	6	128	101		14	0	0	2,323

In-season reports posted weekly
www.fws.gov/arcata/fisheries

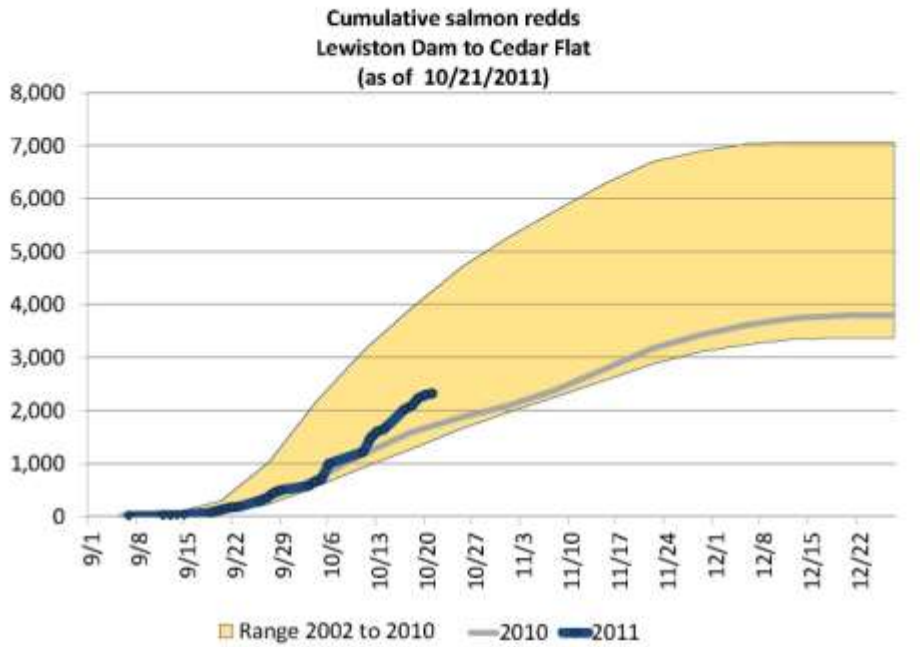


Figure 1. Comparison of fall 2011 cumulative Trinity River mainstem redd counts (Chinook and coho salmon) from Lewiston Dam to Cedar Flat as of 10/14/2011 to counts in 2010 and the range of years 2002-2010.

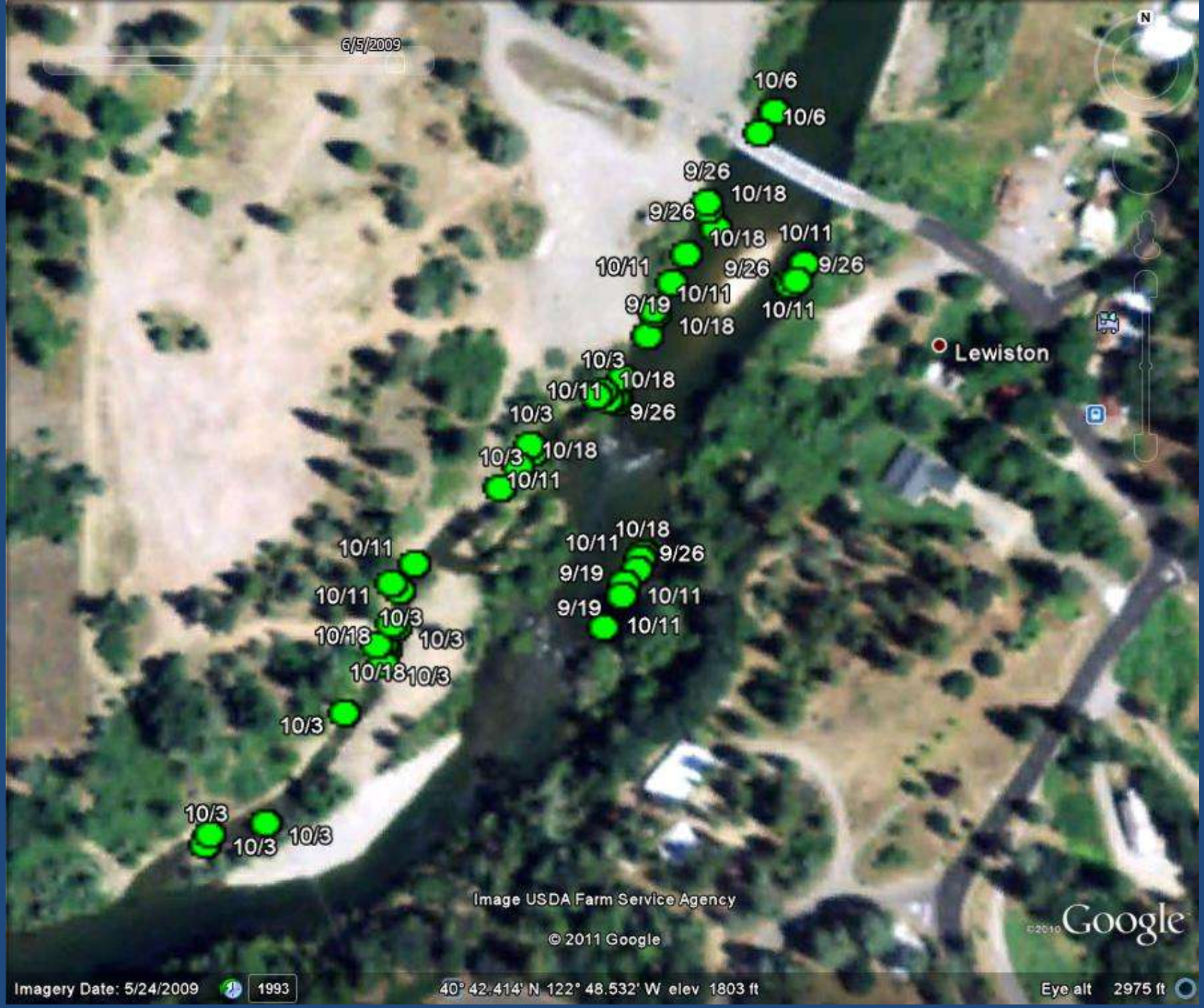
A Keyhole Markup Language file has been created to view redd distribution data with Google Earth.

Redds_up_to_2011_10_21.kml
(last modified October 22, 2011)

If Google Earth fails to launch automatically, the file can be used by first saving it to your computer then launching the Google Earth application. Select the menu option **File**, **Open**, locate the downloaded file (Redds_up_to_2011_10_21.kml); and click the **Open** button.

Note: Background imagery in Google Earth is sometimes not projected with perfect accuracy. Redd locations may appear to be mapped on dry ground in those cases when viewed with Google Earth, but they are indeed in the water! Likewise, the river has changed since the most recently available Google Earth imagery.

For more information regarding mainstem Trinity River redd surveys, please contact Charlie Chamberlain at (707) 822-7201 or charles_chamberlain@fws.gov


6/5/2009
10/6
10/6
9/26
10/18
9/26
10/18
10/11
10/11
9/26
9/26
10/11
9/19
10/11
10/18
10/11
Lewiston
10/3
10/18
10/11
9/26
10/3
10/3
10/18
10/11
10/11
10/18
9/26
9/19
10/11
9/19
10/11
10/3
10/18
10/3
10/18
10/3
10/3
10/3
10/3
10/3
Image USDA Farm Service Agency
© 2011 Google
©2010 Google
Imagery Date: 5/24/2009
1993
40° 42.414' N 122° 48.532' W elev 1803 ft
Eye alt 2975 ft

Project Reporting

1. Reporting of information
   a) Final edits/response to reviewer comments in progress for 2002 to 2010 report.
   b) Envision smaller annual reports, then periodic (5-10 years?) trend analysis.
   c) Data are shared in GIS format with TRRP design teams
   d) In-season reports are posted weekly
2. Data storage
   a) Data stored in GIS format, and backed up weekly on FWS servers

Issues/Challenges/Feedback to TRRP

1. Issues/challenges
    a) Can’t differentiate spring vs. fall

Issues/Challenges/Feedback to TRRP

1. Issues/challenges
   a) Can't differentiate spring vs. fall
   b) Storms occasionally cut our season short – especially in the lower river

Issues/Challenges/Feedback to TRRP

1. Issues/challenges
   a) Can't differentiate spring vs. fall
   b) Storms occasionally cut our season short – especially in the lower river
   c) Equipment or operator malfunction

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1. Issues/challenges
   a) Can't differentiate spring vs. fall
   b) Storms occasionally cut our season short – especially in the lower river
   c) Equipment or operator malfunction
   d) Chinook season only

Issues/Challenges/Feedback to TRRP

1. Issues/challenges
   a) Can't differentiate spring vs. fall
   b) Storms occasionally cut our season short – especially in the lower river
   c) Equipment or operator malfunction
   d) Chinook season only
   e) Limited to probability of species or origin for each redd

Issues/Challenges/Feedback to TRRP

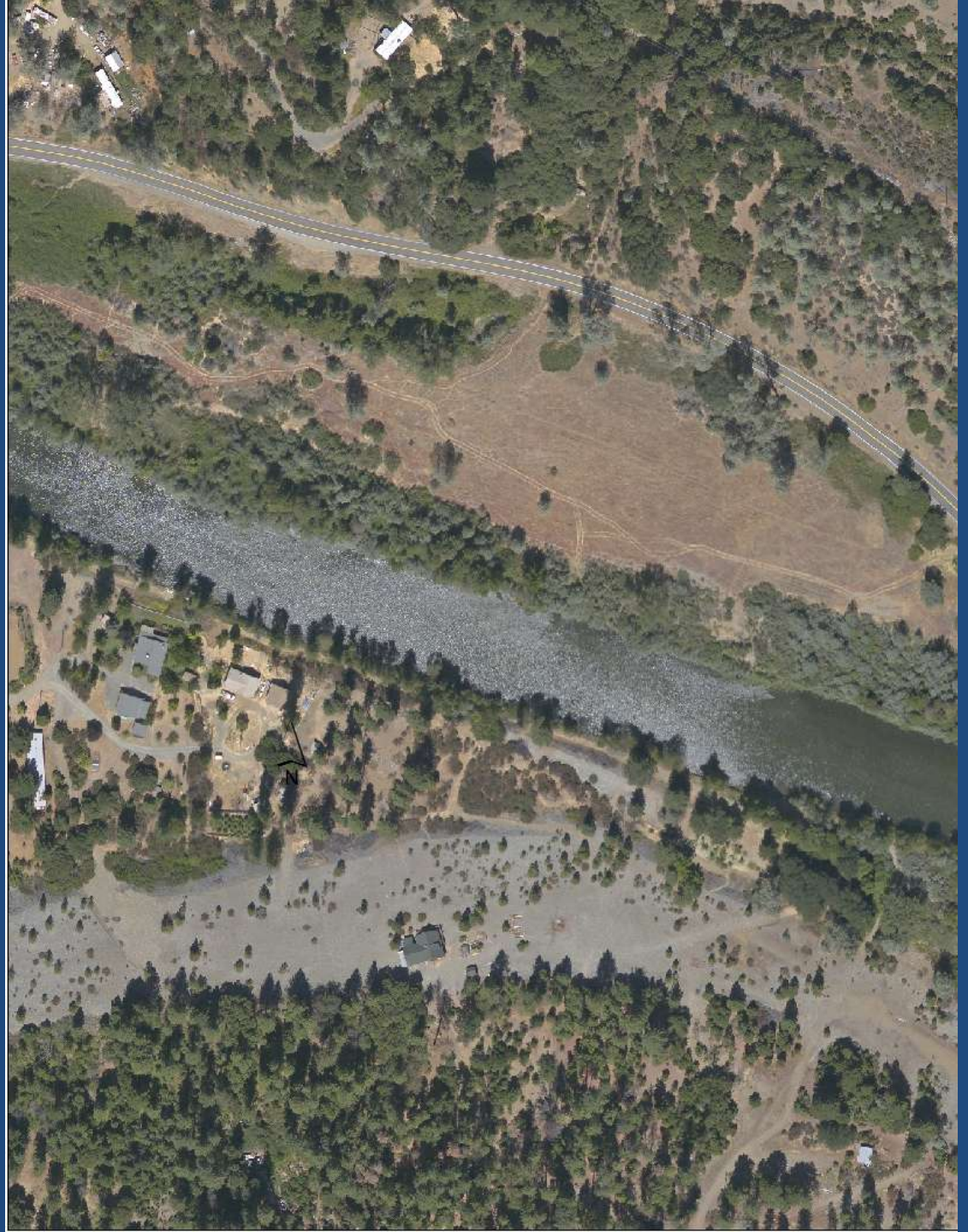
1. Issues/challenges
   a) Can't differentiate spring vs. fall
   b) Storms occasionally cut our season short – especially in the lower river
   c) Equipment or operator malfunction
   d) Chinook season only
   e) Limited to probability of species or origin for each redd
   f) Under-recognized sources of error
      1) Variability in temporal lag
      2) Variability in redds/female
      3) Variability in recovery of carcasses
      4) "Census" errors due to superimposition

Issues/Challenges/Feedback to TRRP

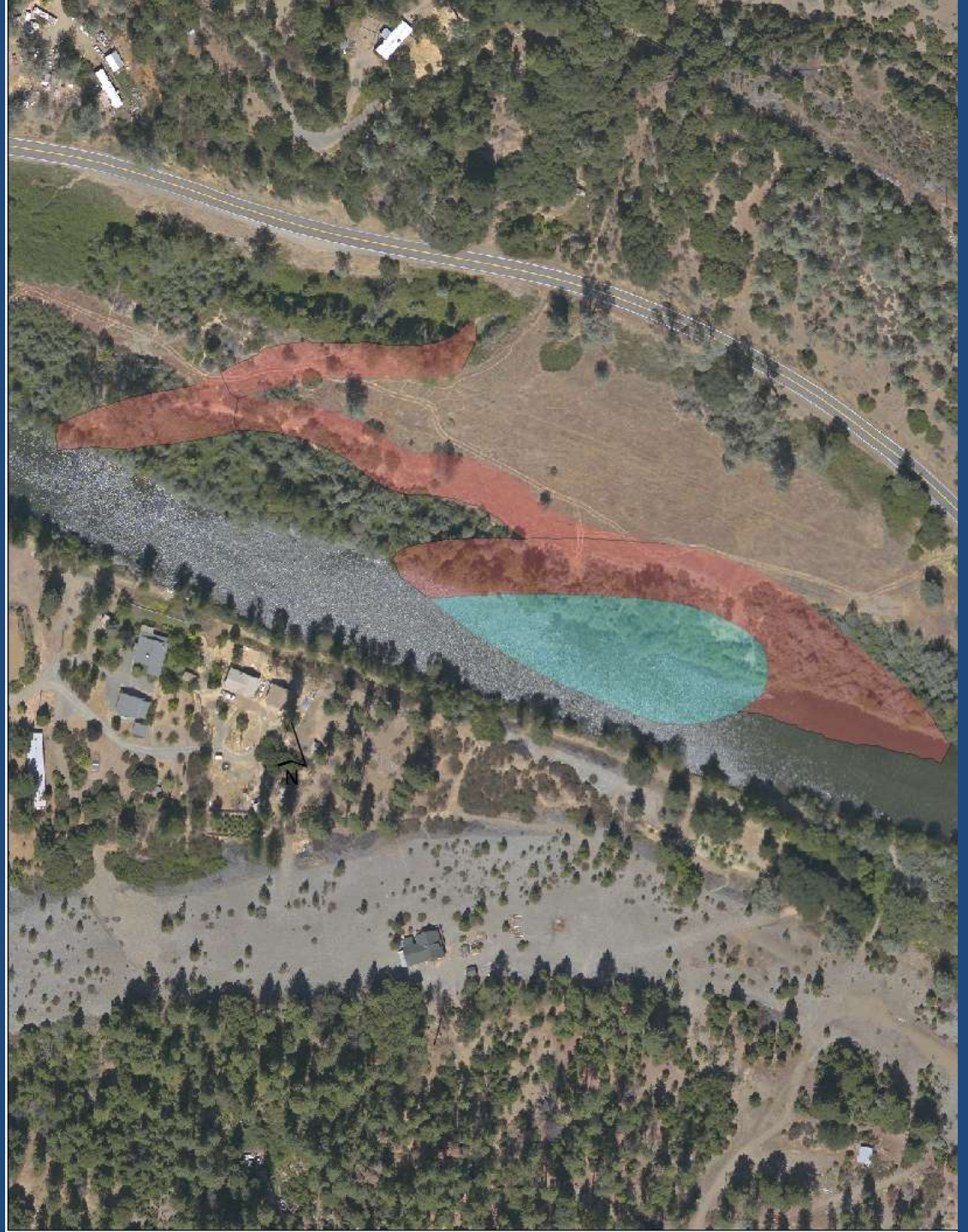
2. Present what we have learned from implementing this project (even preliminary analyses) in assessing the effectiveness of the TRRP.

Some examples….

Wheel Gulch



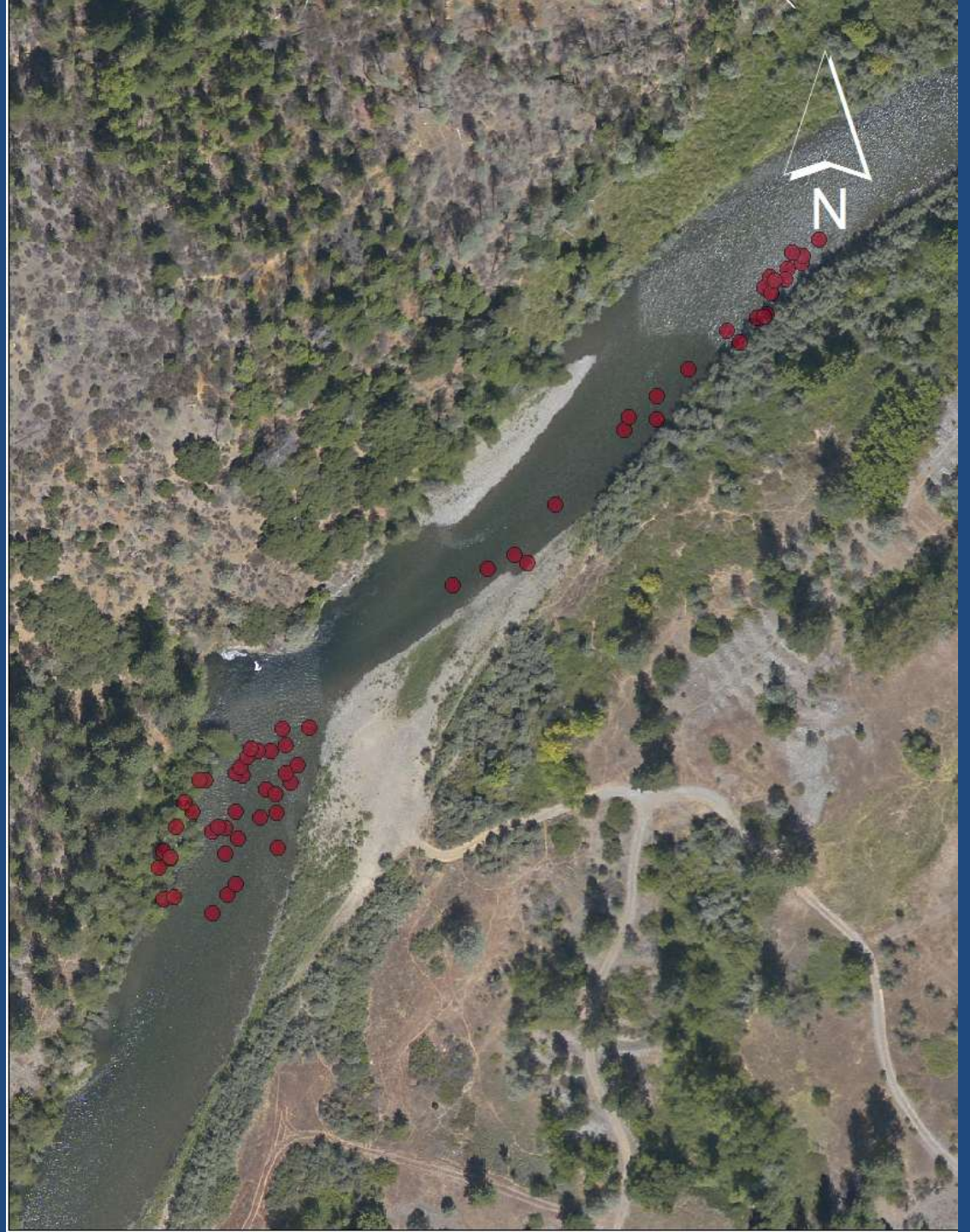
Wheel Gulch



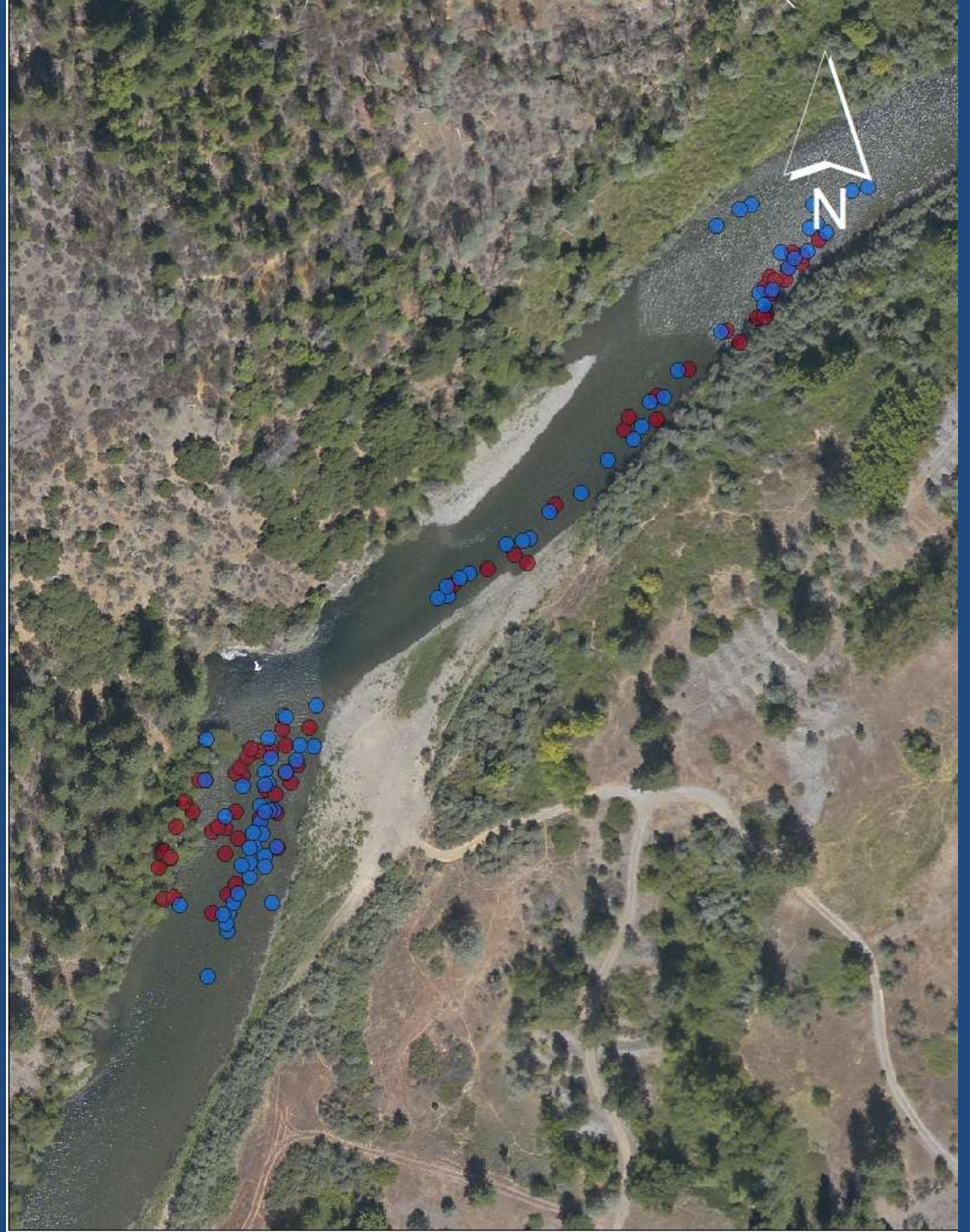
Wheel Gulch

Sheridan Creek

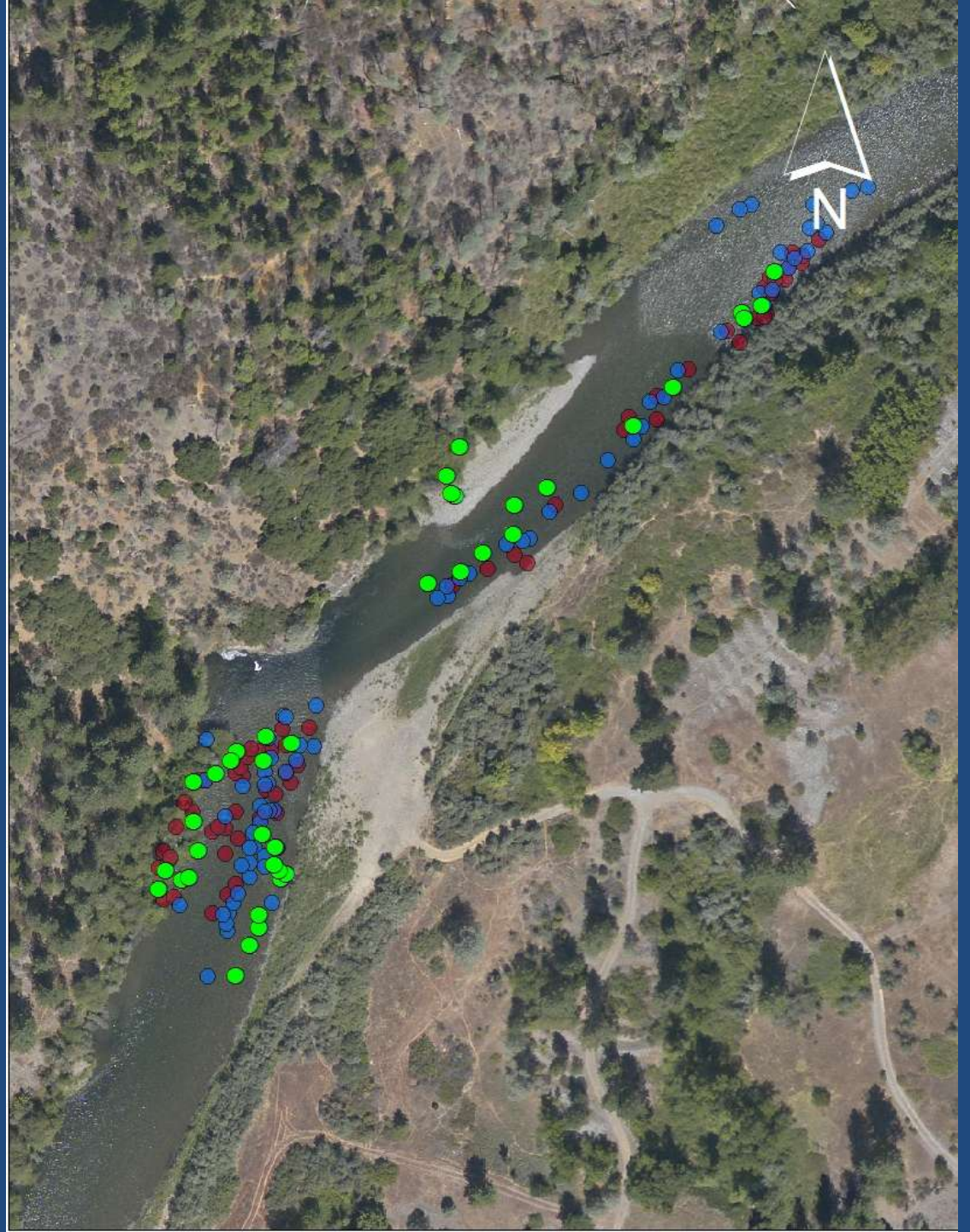
Sheridan Creek



Sheridan Creek

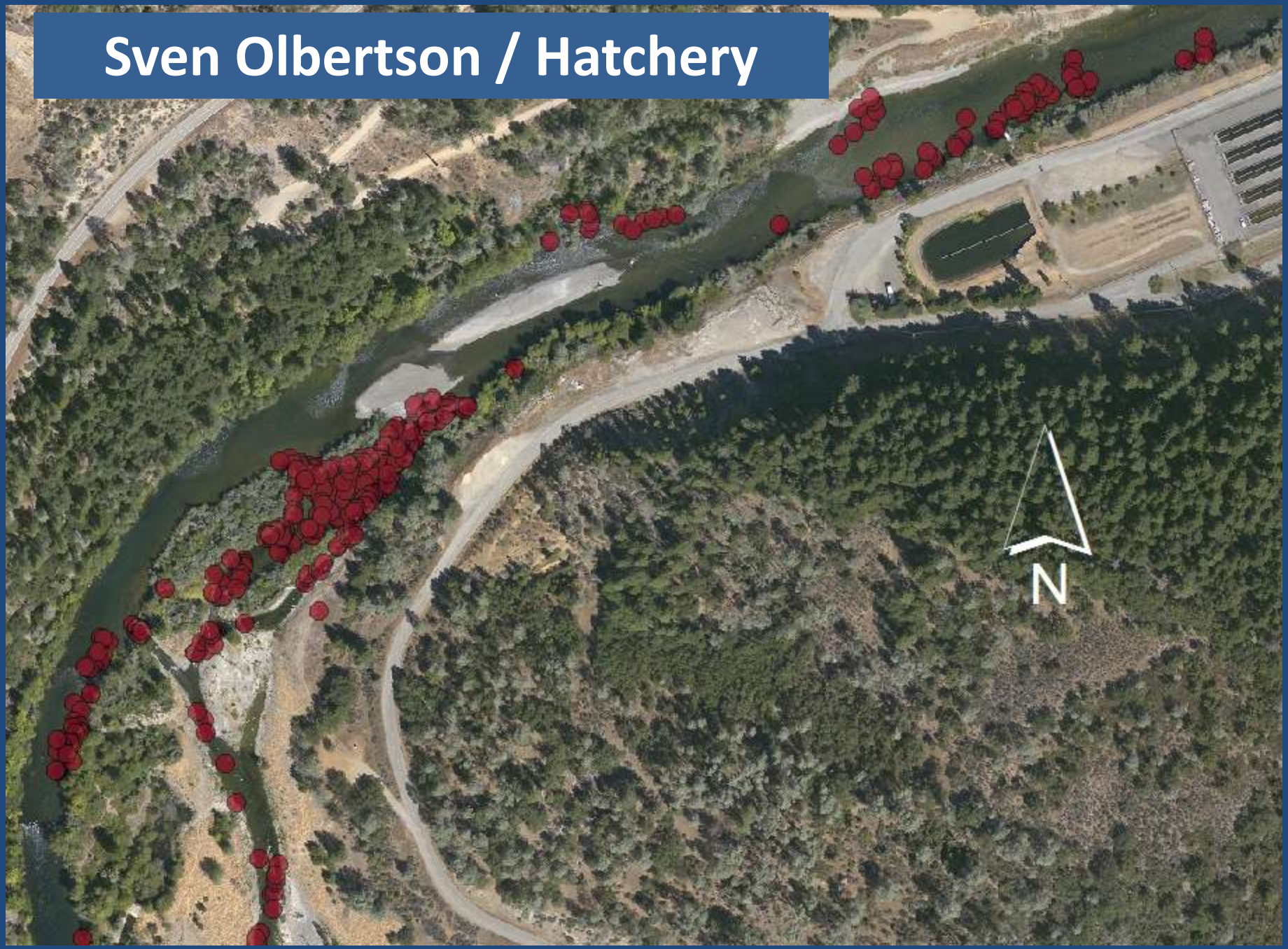


Sheridan Creek

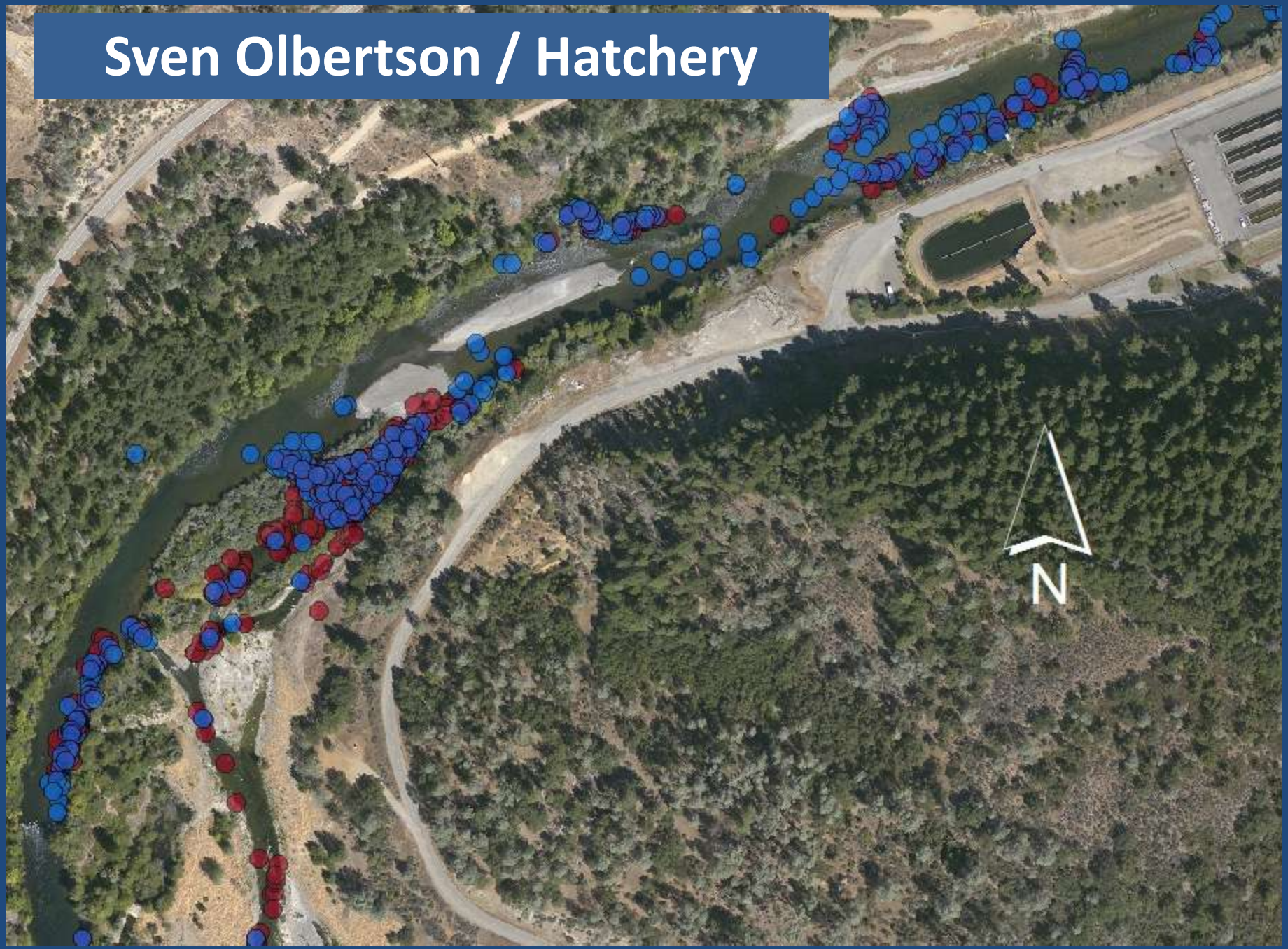


Sven Olbertson / Hatchery

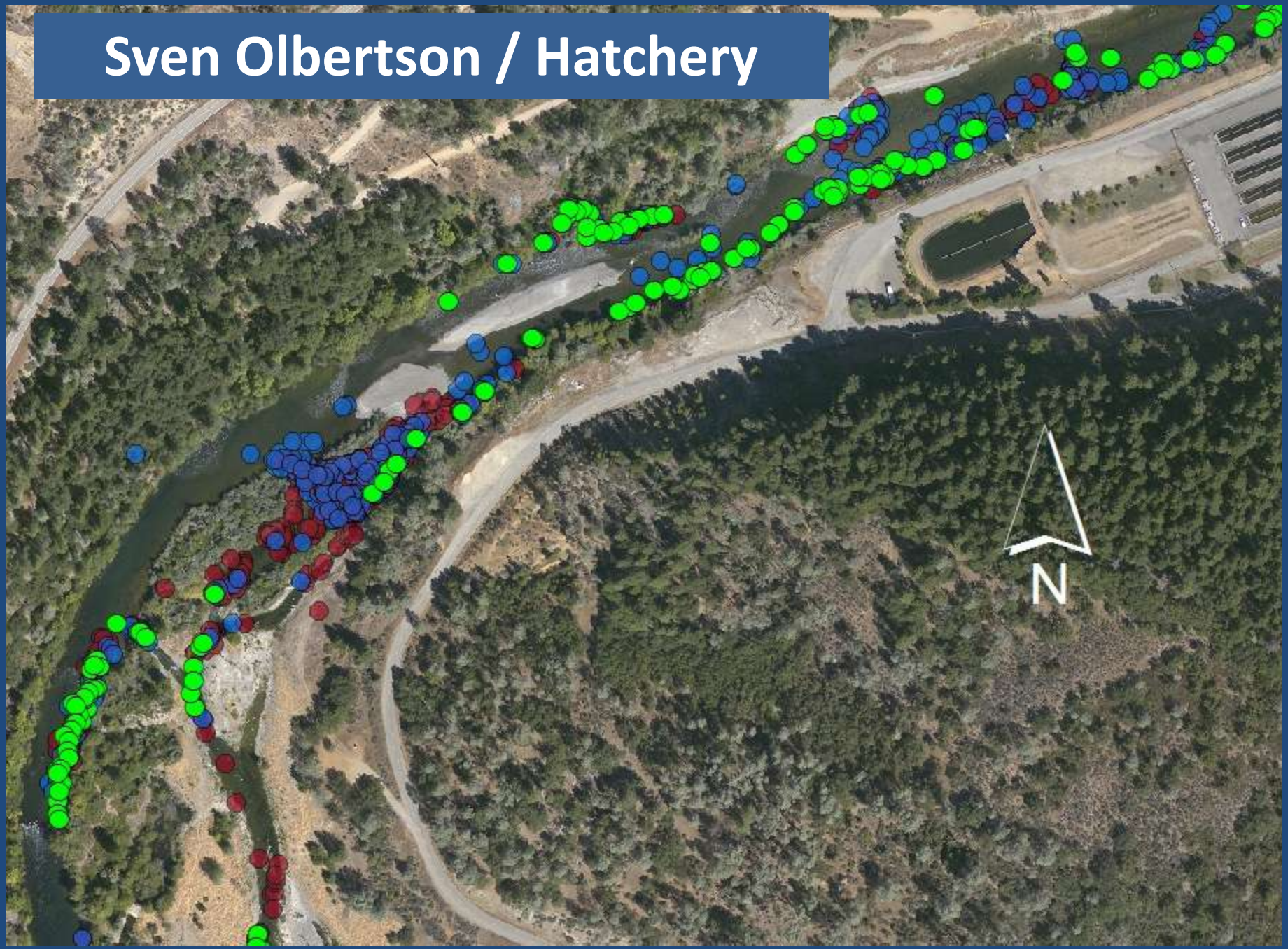
Sven Olbertson / Hatchery

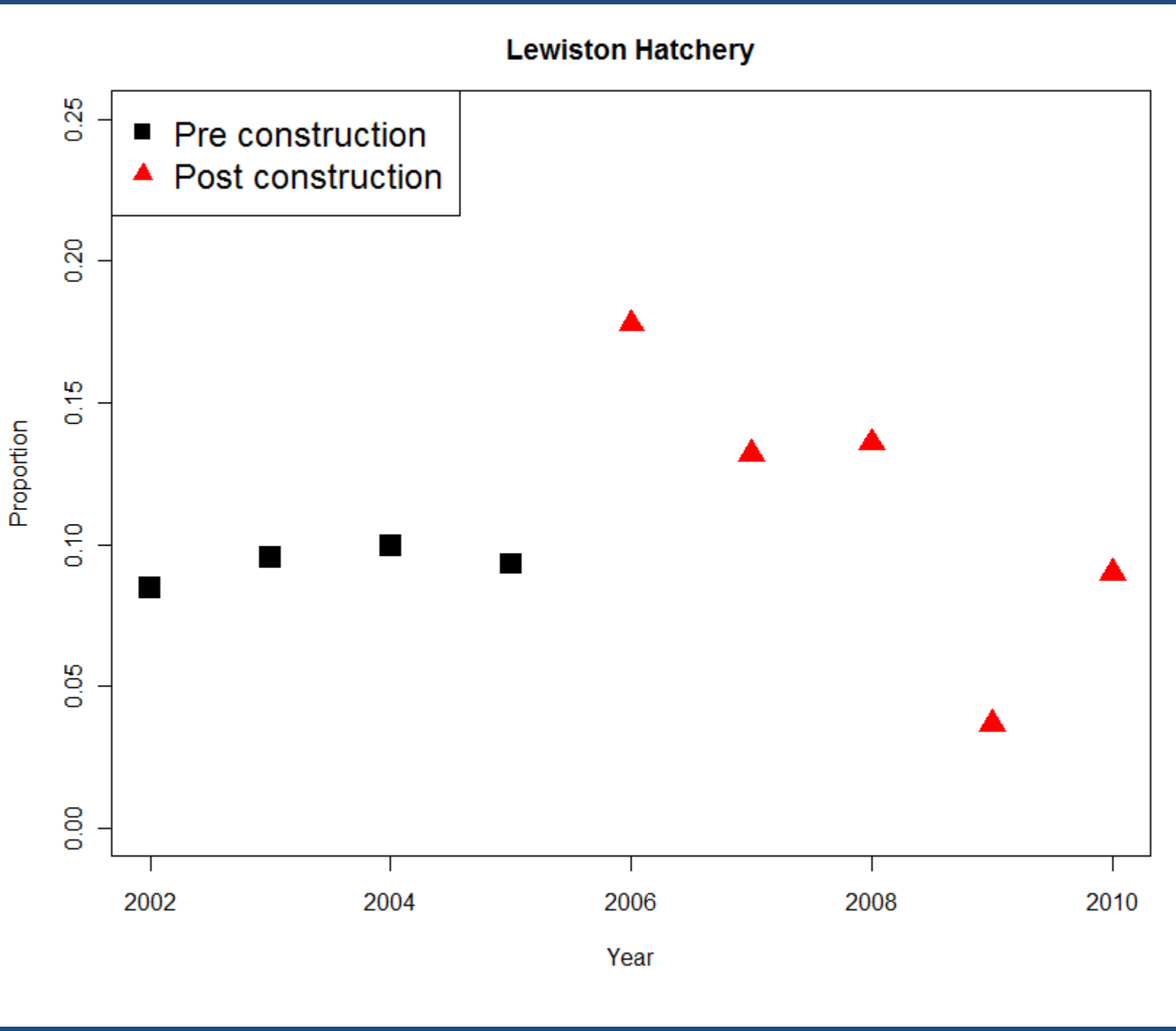


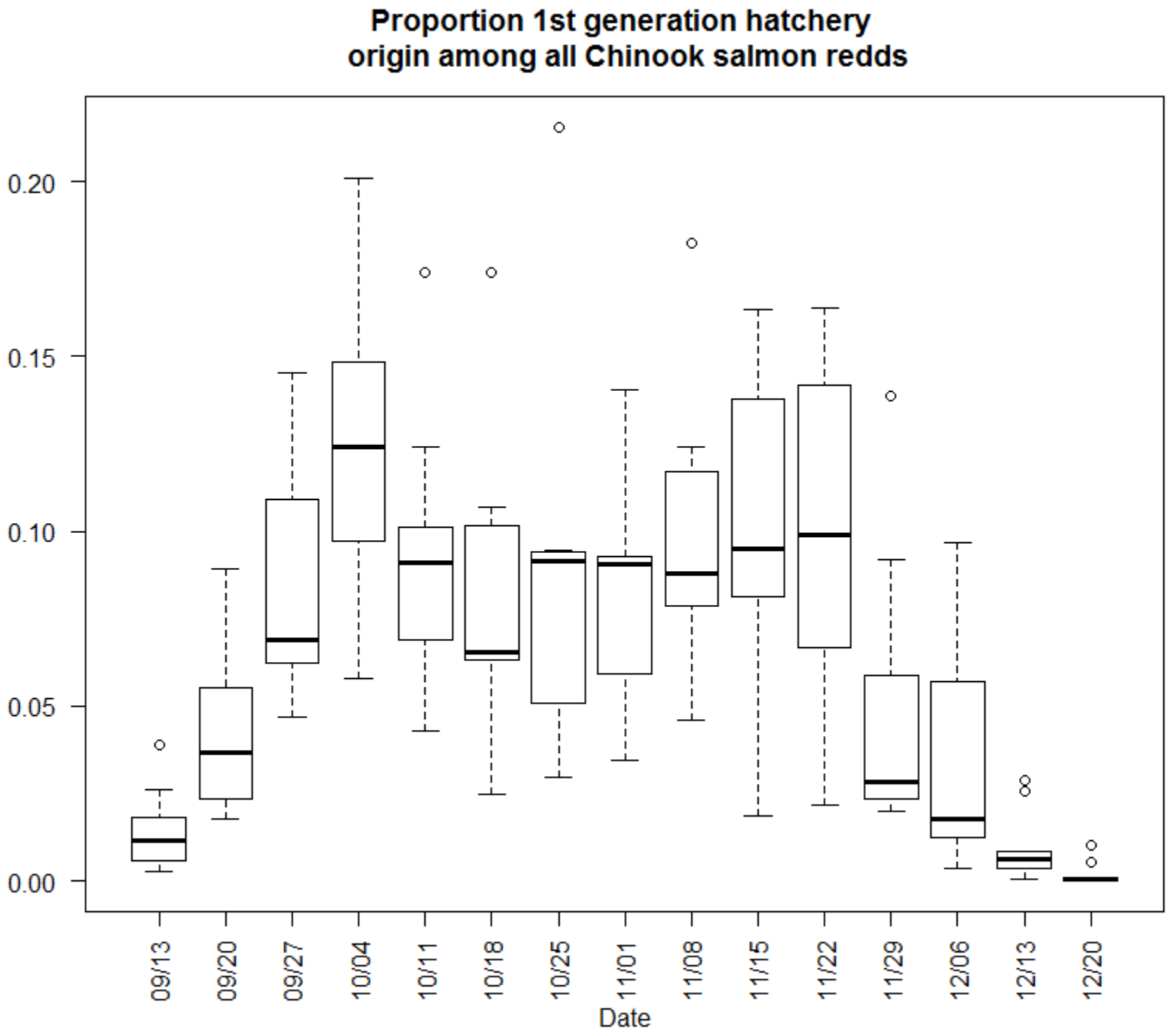
Sven Olbertson / Hatchery

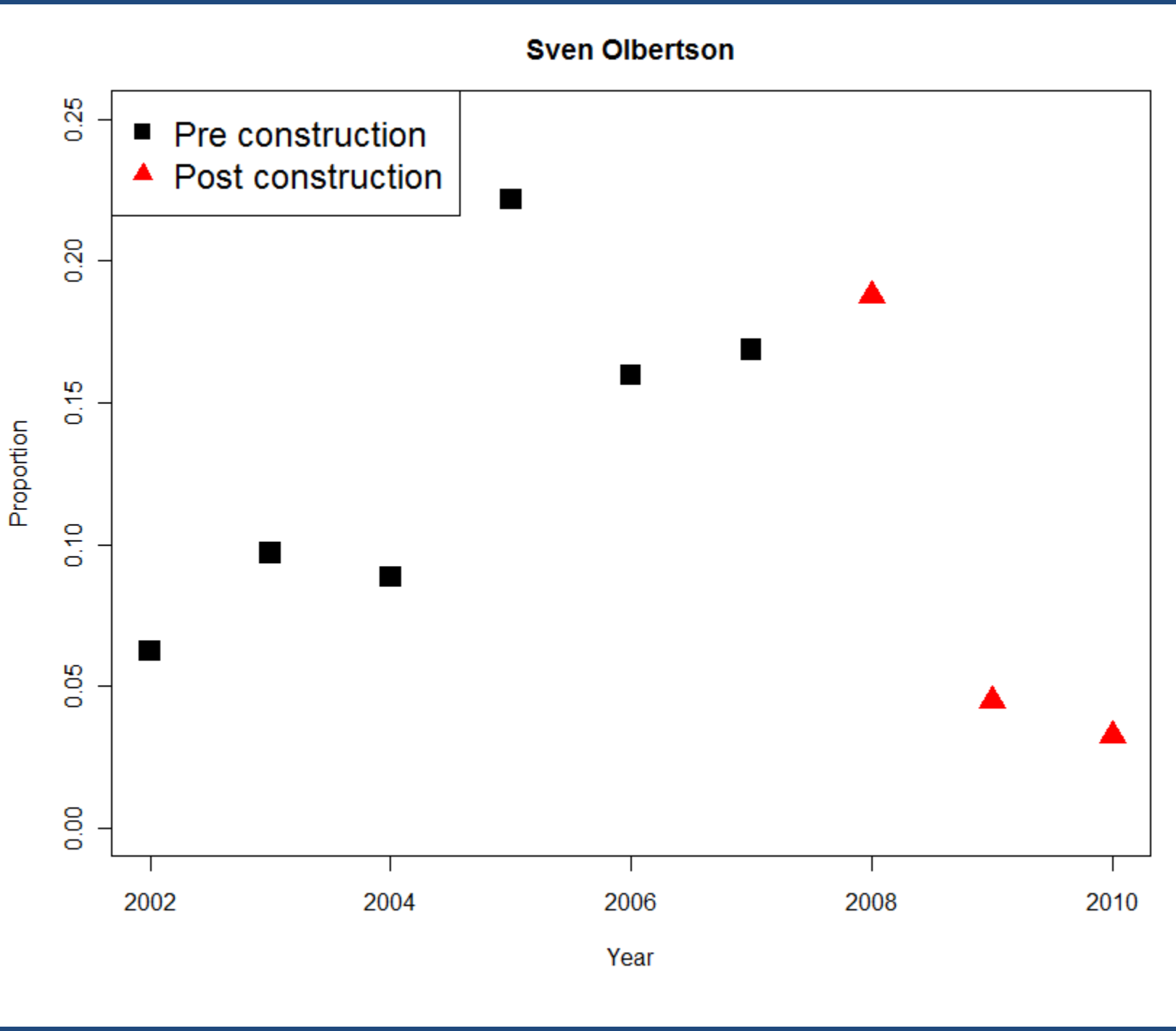


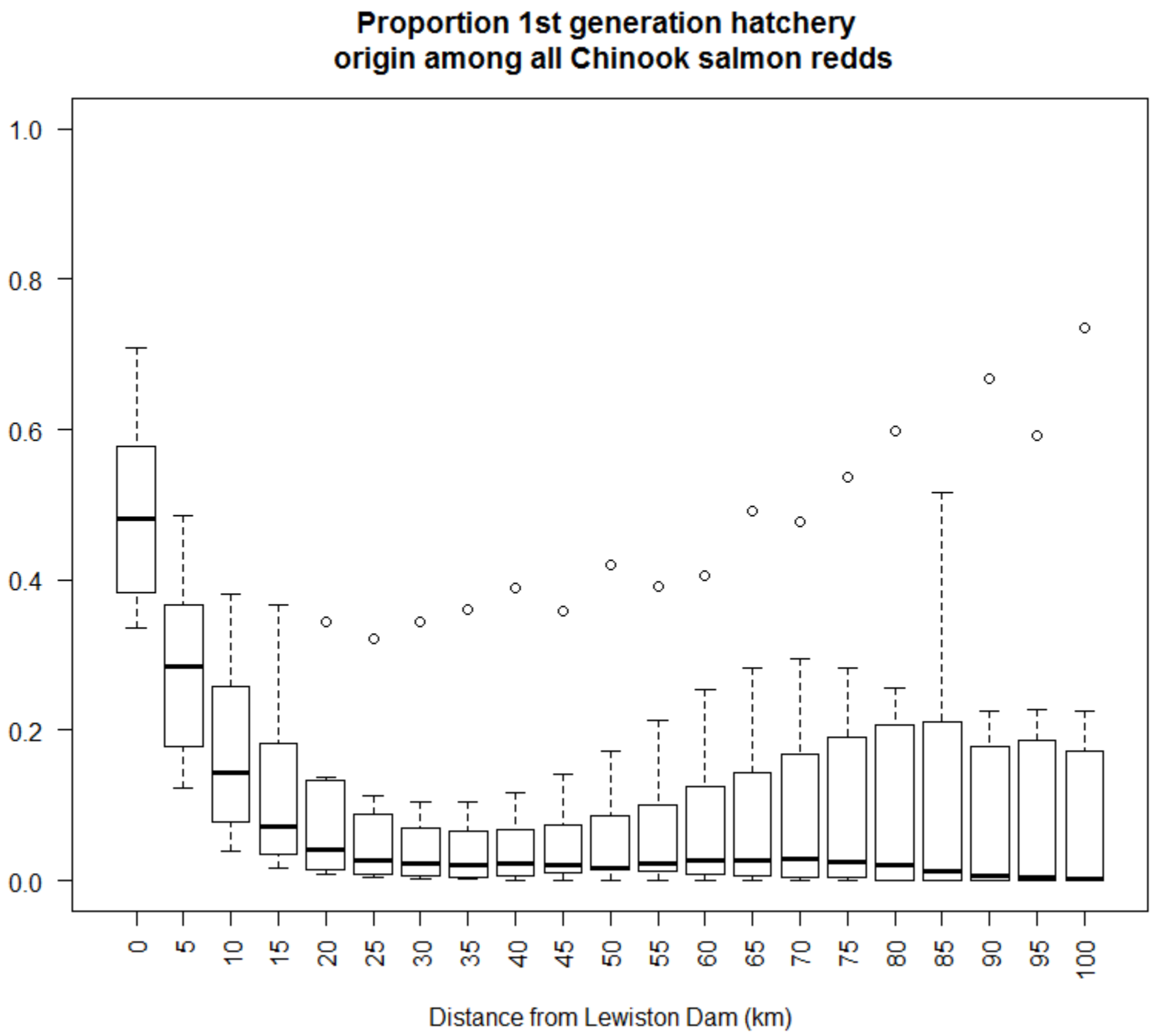
Sven Olbertson / Hatchery

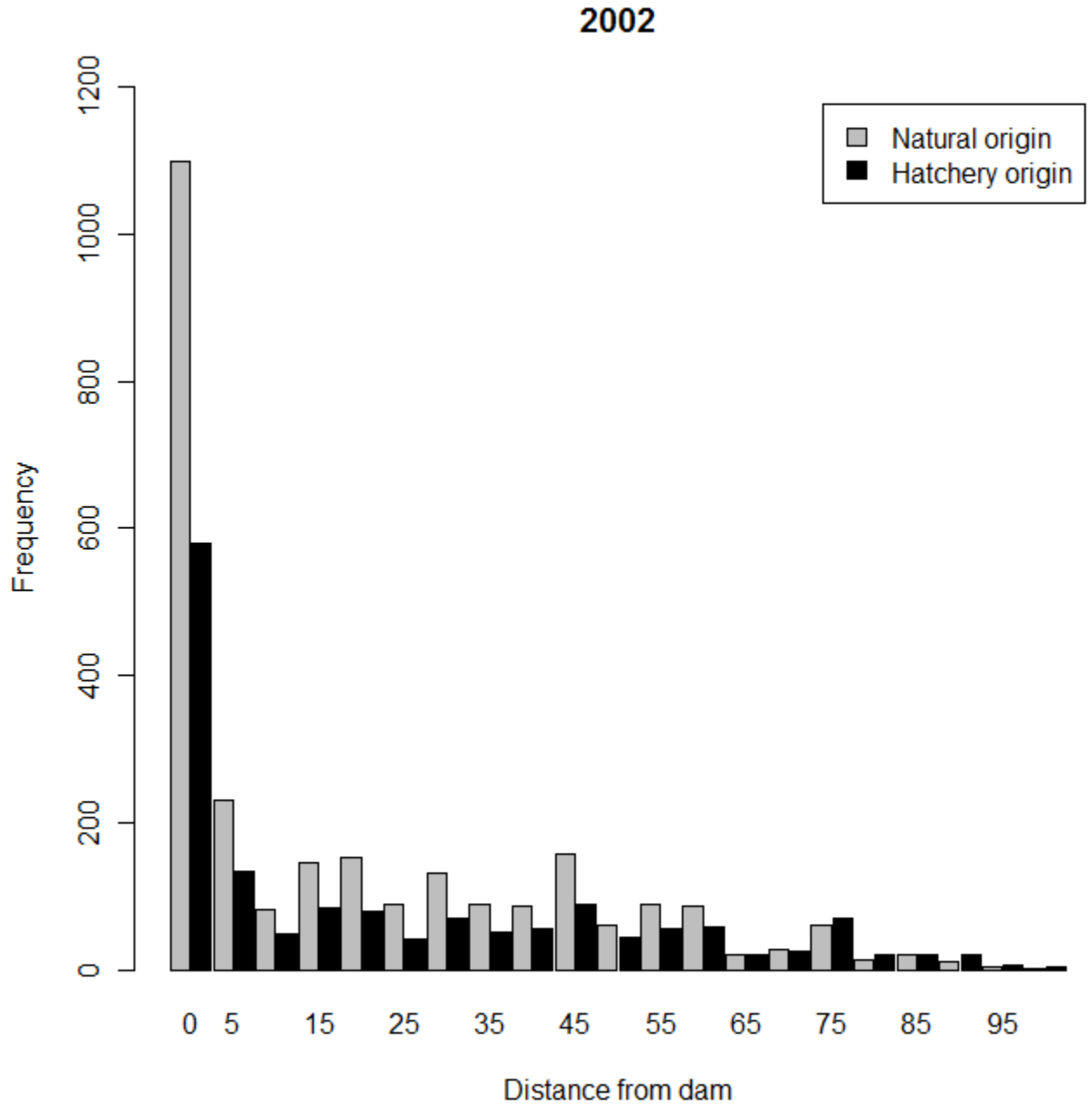


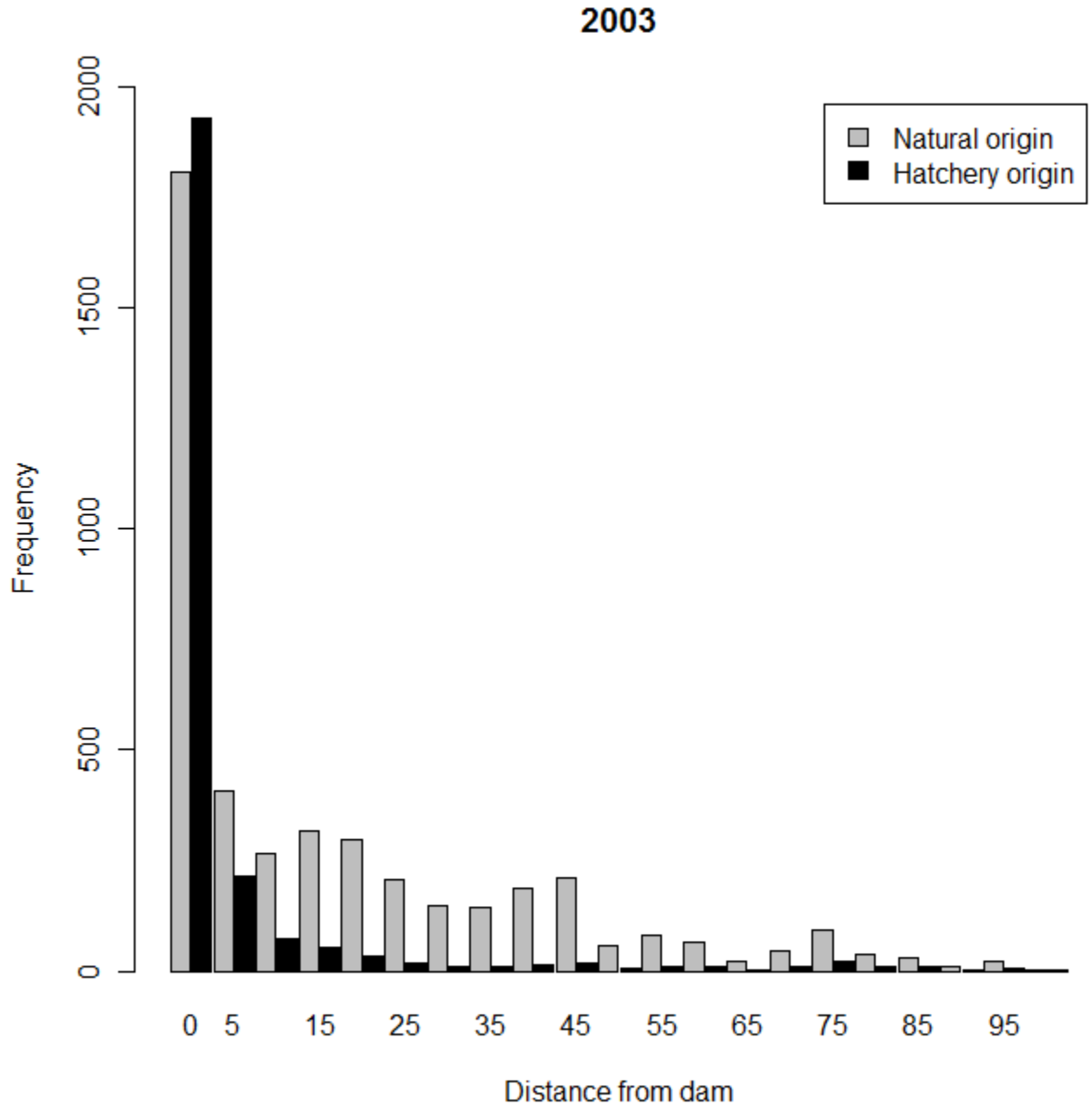

Lewiston Hatchery
Pre construction
Post construction
Proportion
0.00
0.05
0.10
0.15
0.20
0.25
2002
2004
2006
2008
2010
Year

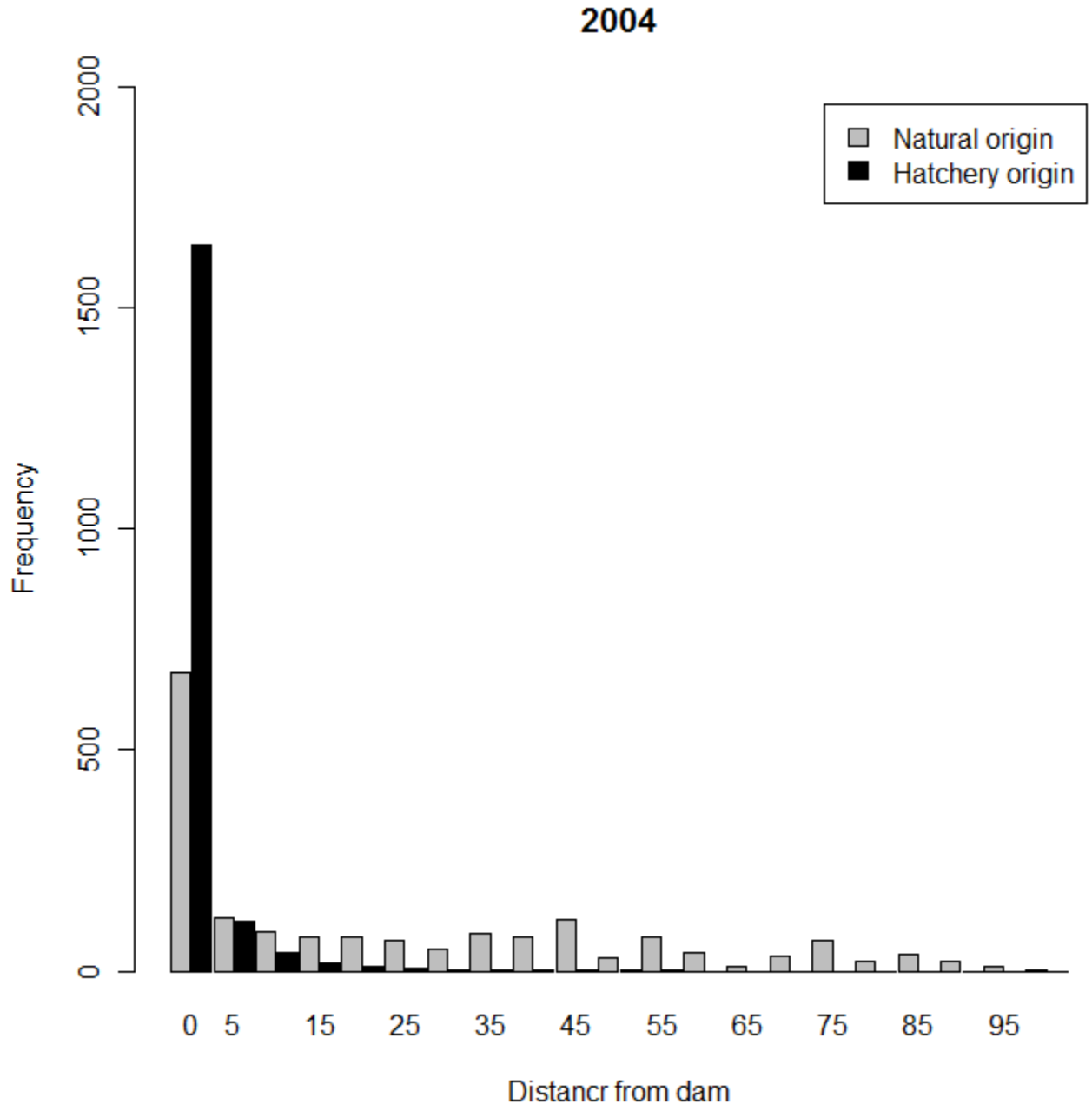

Proportion 1st generation hatchery origin among all Chinook salmon redds
0.20
0.15
0.10
0.05
0.00
09/13
09/20
09/27
10/04
10/11
10/18
10/25
11/01
11/08
11/15
11/22
11/29
12/06
12/13
12/20
Date

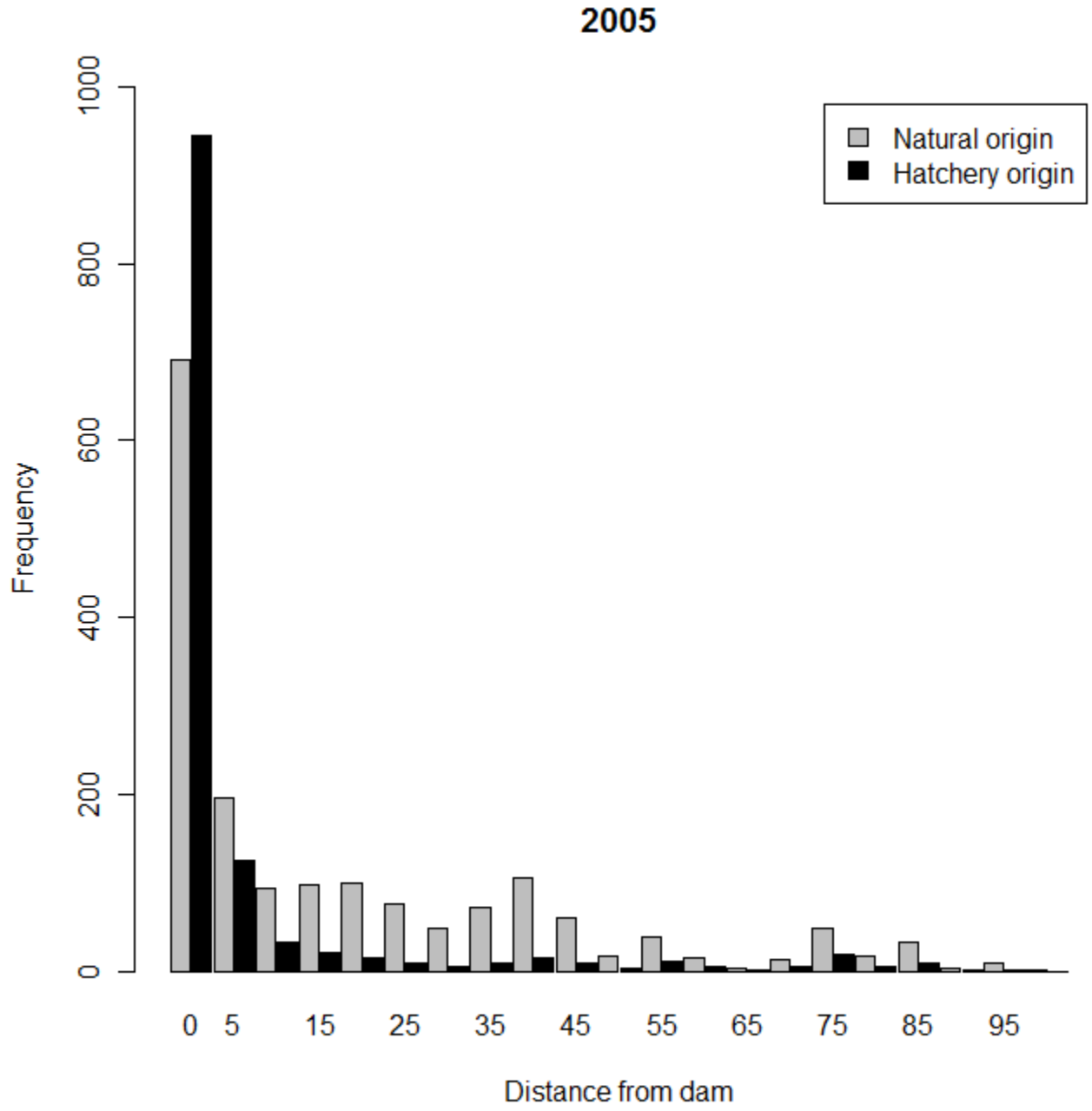

Sven Olbertson
Pre construction
Post construction
Proportion
0.00
0.05
0.10
0.15
0.20
0.25
2002
2004
2006
2008
2010
Year

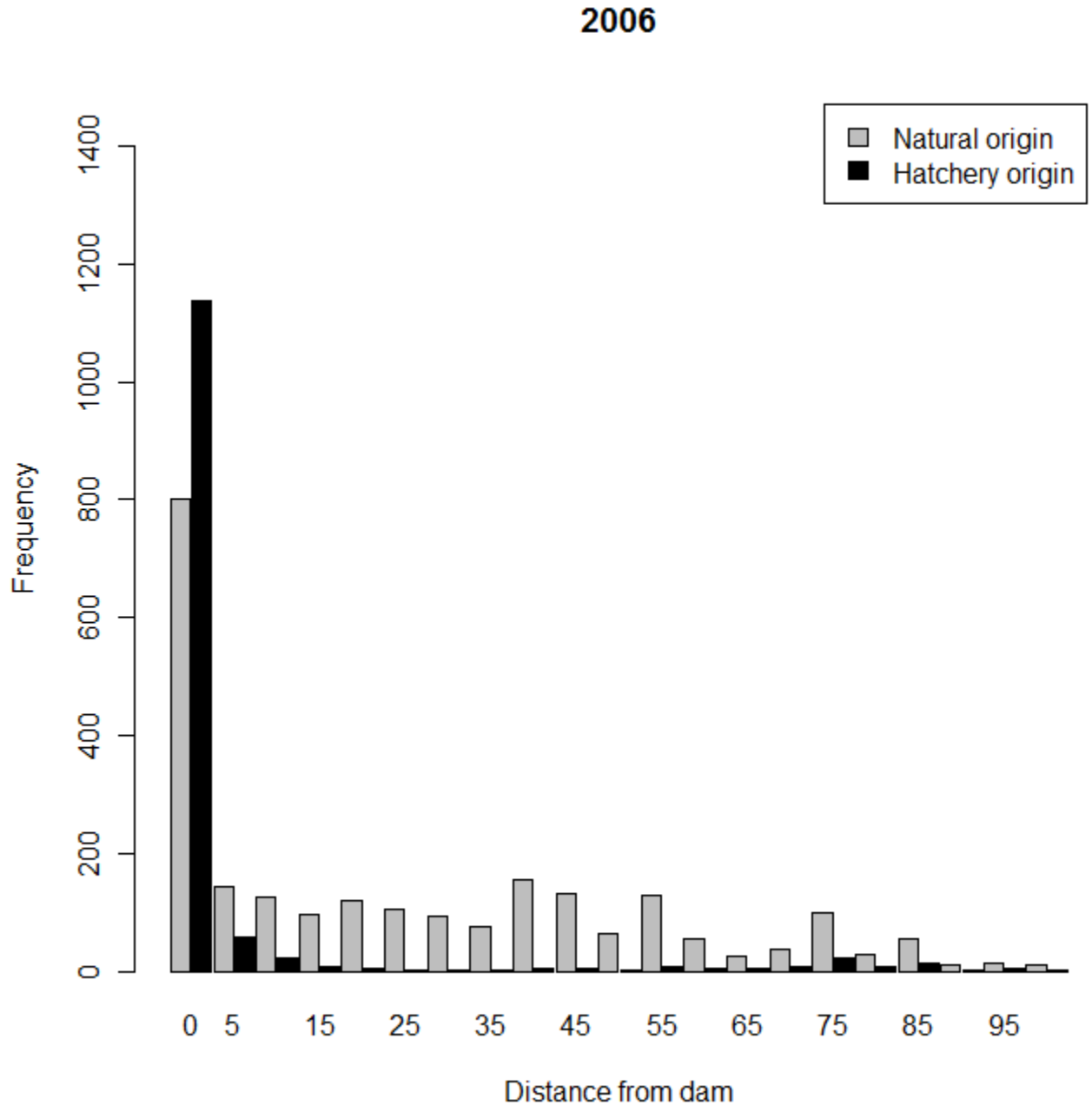

Proportion 1st generation hatchery origin among all Chinook salmon redds
1.0
0.8
0.6
0.4
0.2
0.0
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95
100
Distance from Lewiston Dam (km)

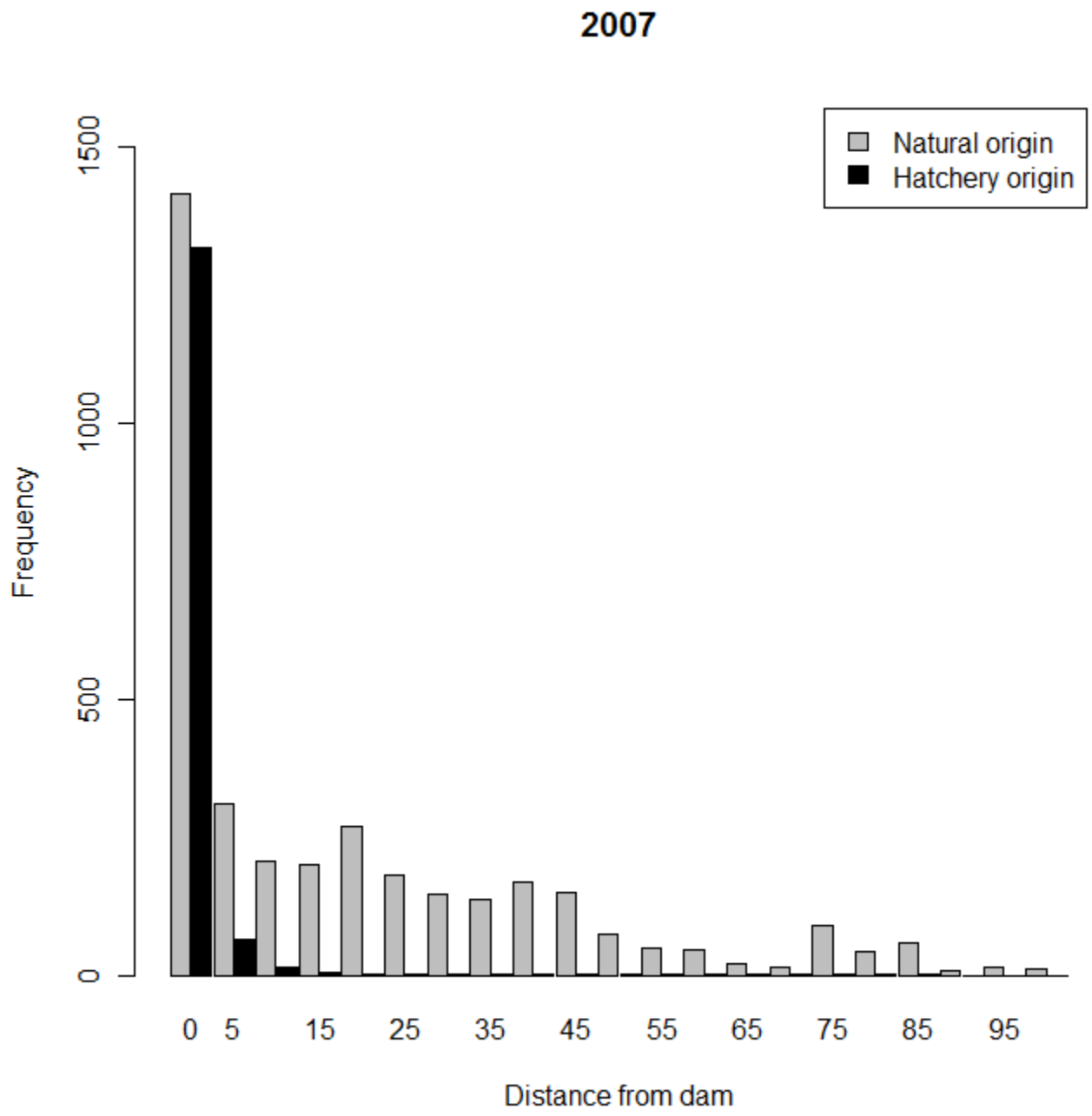

2002
Natural origin
Hatchery origin
Frequency
0
200
400
600
800
1000
1200
0
5
15
25
35
45
55
65
75
85
95
Distance from dam

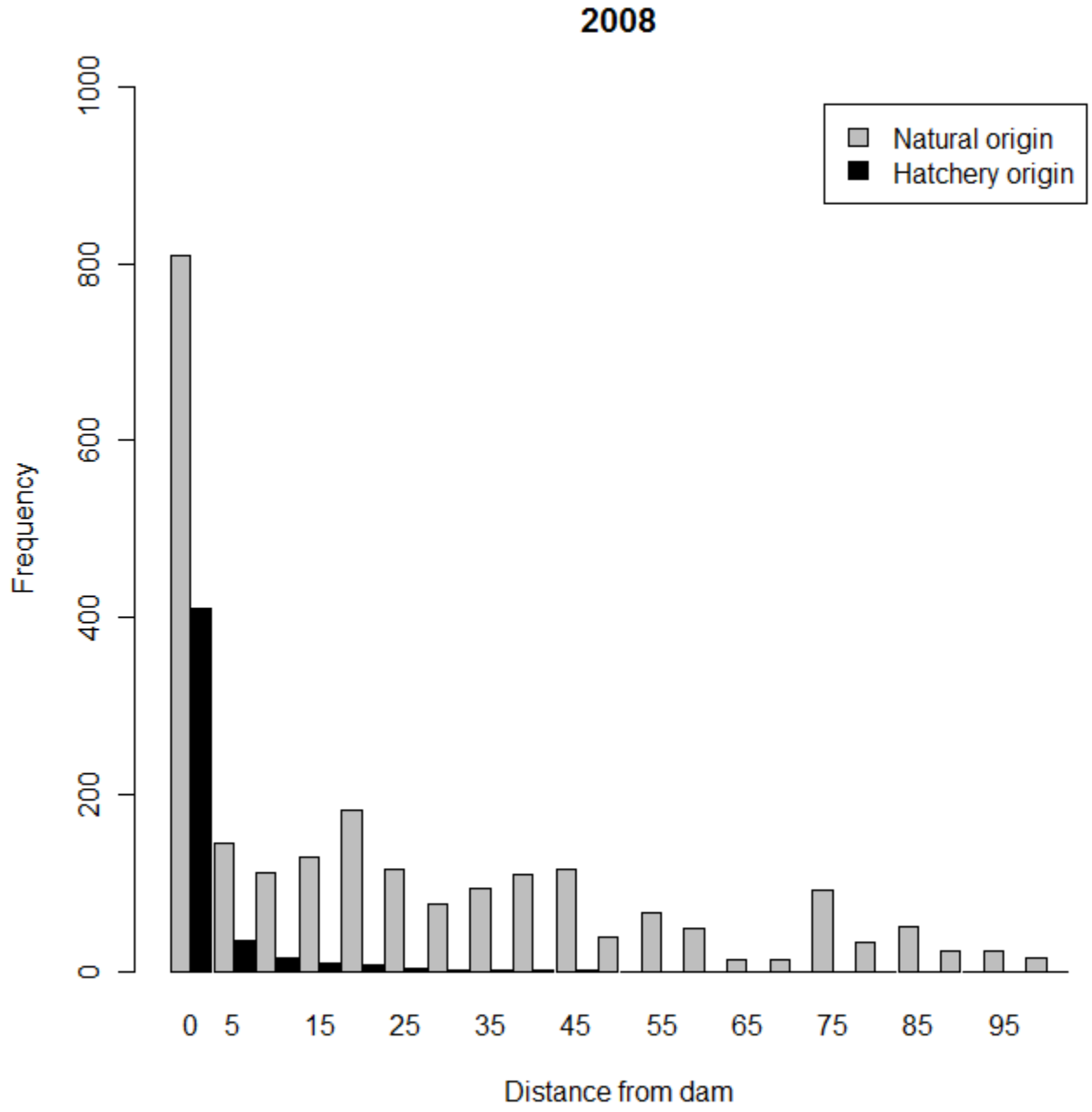

2003
Natural origin
Hatchery origin
Frequency
0
500
1000
1500
2000
0
5
15
25
35
45
55
65
75
85
95
Distance from dam

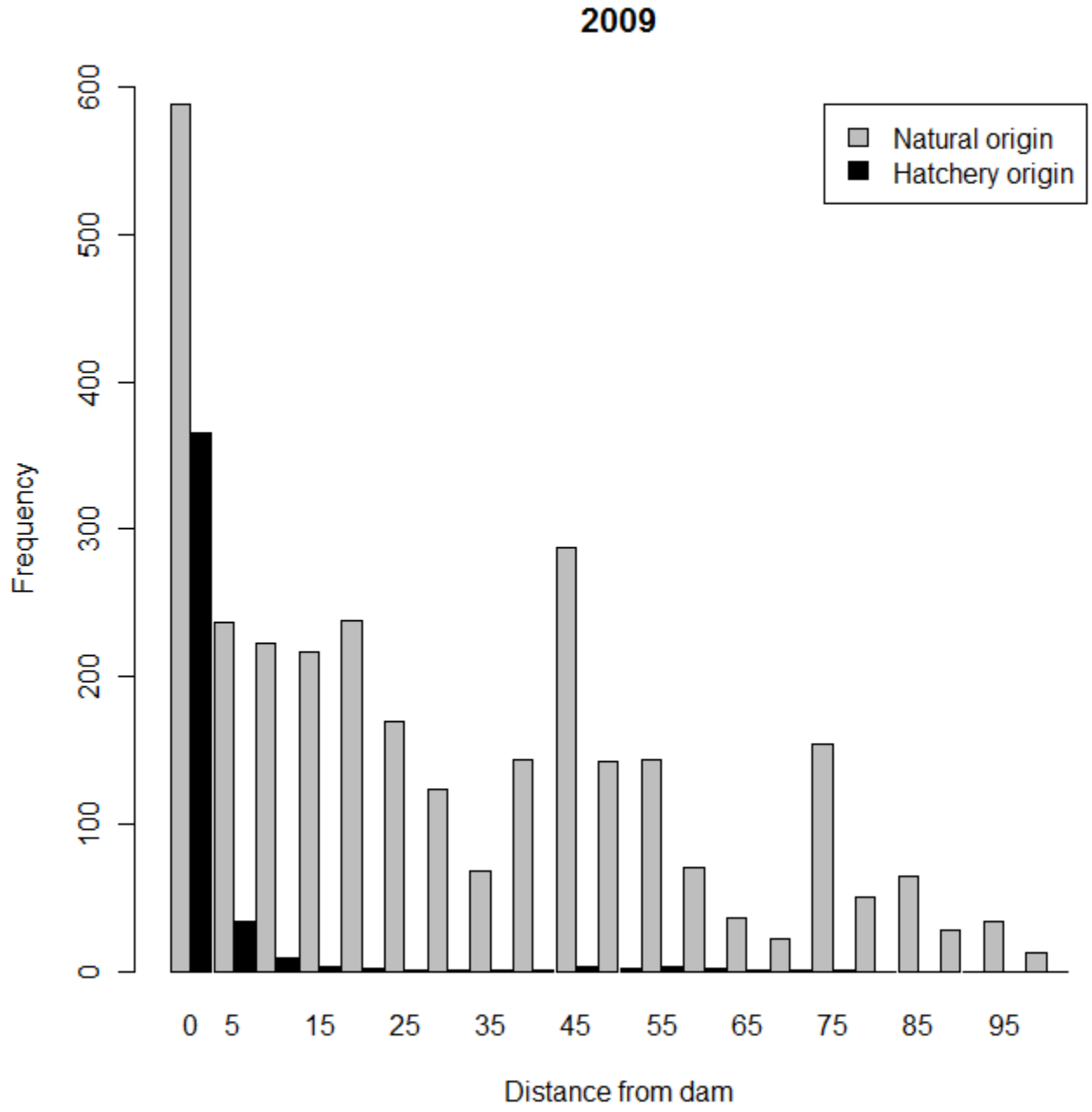

2004
Natural origin
Hatchery origin
Frequency
0
500
1000
1500
2000
0
5
15
25
35
45
55
65
75
85
95
Distancr from dam

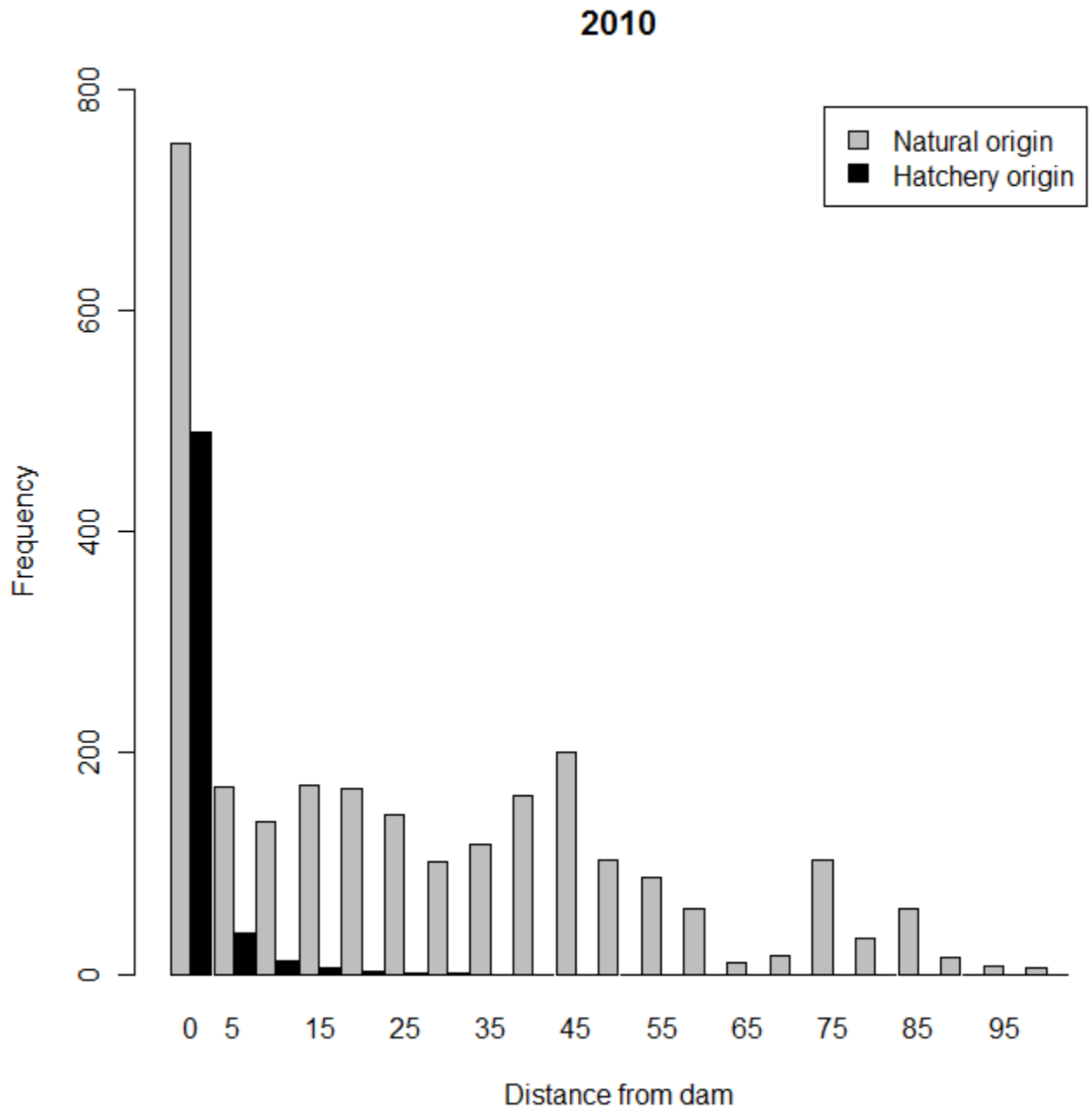

2005
Natural origin
Hatchery origin
Frequency
0
200
400
600
800
1000
0
5
15
25
35
45
55
65
75
85
95
Distance from dam


2006
Natural origin
Hatchery origin
Frequency
0
200
400
600
800
1000
1200
1400
0
5
15
25
35
45
55
65
75
85
95
Distance from dam

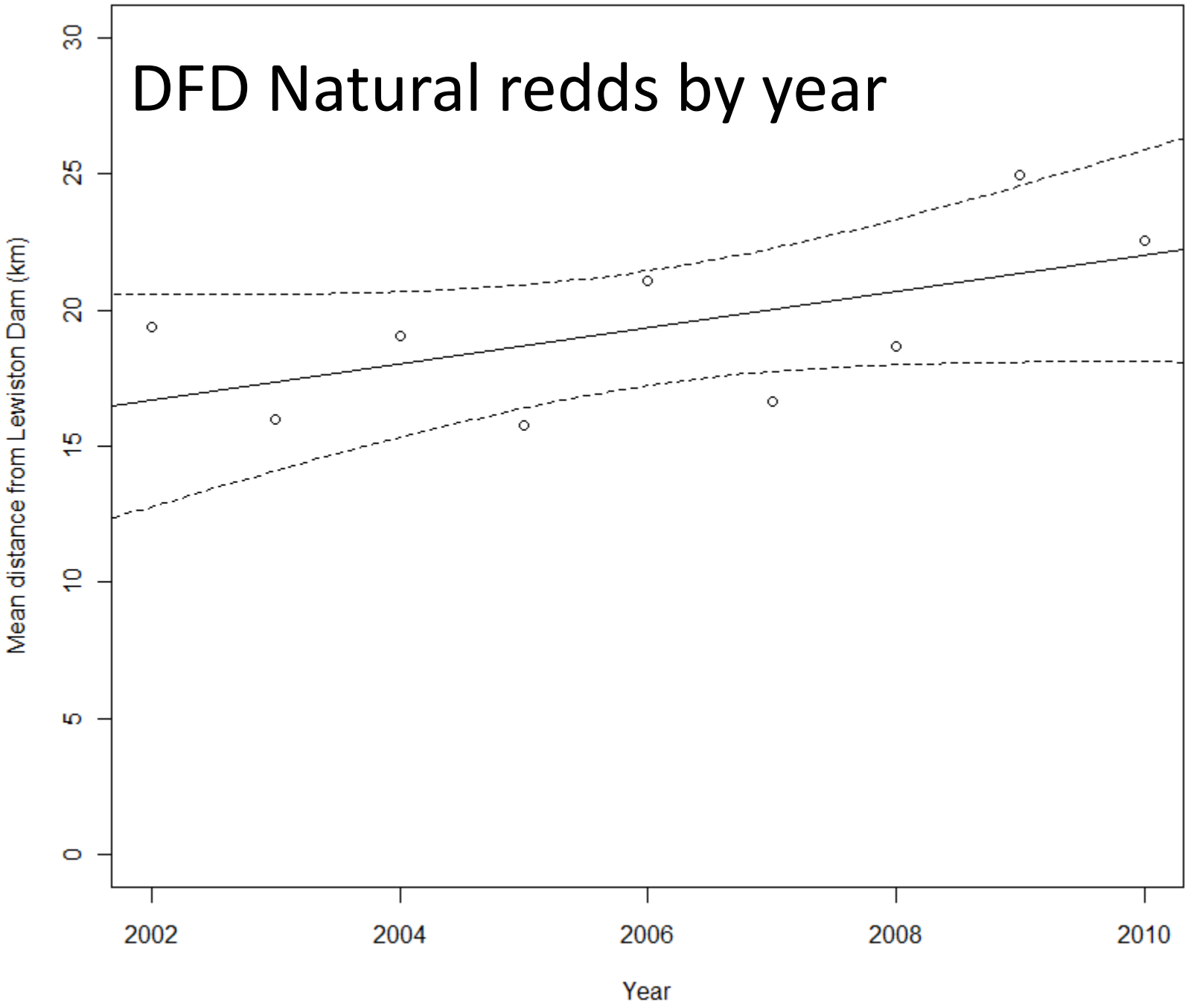

2007
Natural origin
Hatchery origin
Frequency
0
500
1000
1500
0
5
15
25
35
45
55
65
75
85
95
Distance from dam


2008
Natural origin
Hatchery origin
Frequency
0
200
400
600
800
1000
0
5
15
25
35
45
55
65
75
85
95
Distance from dam

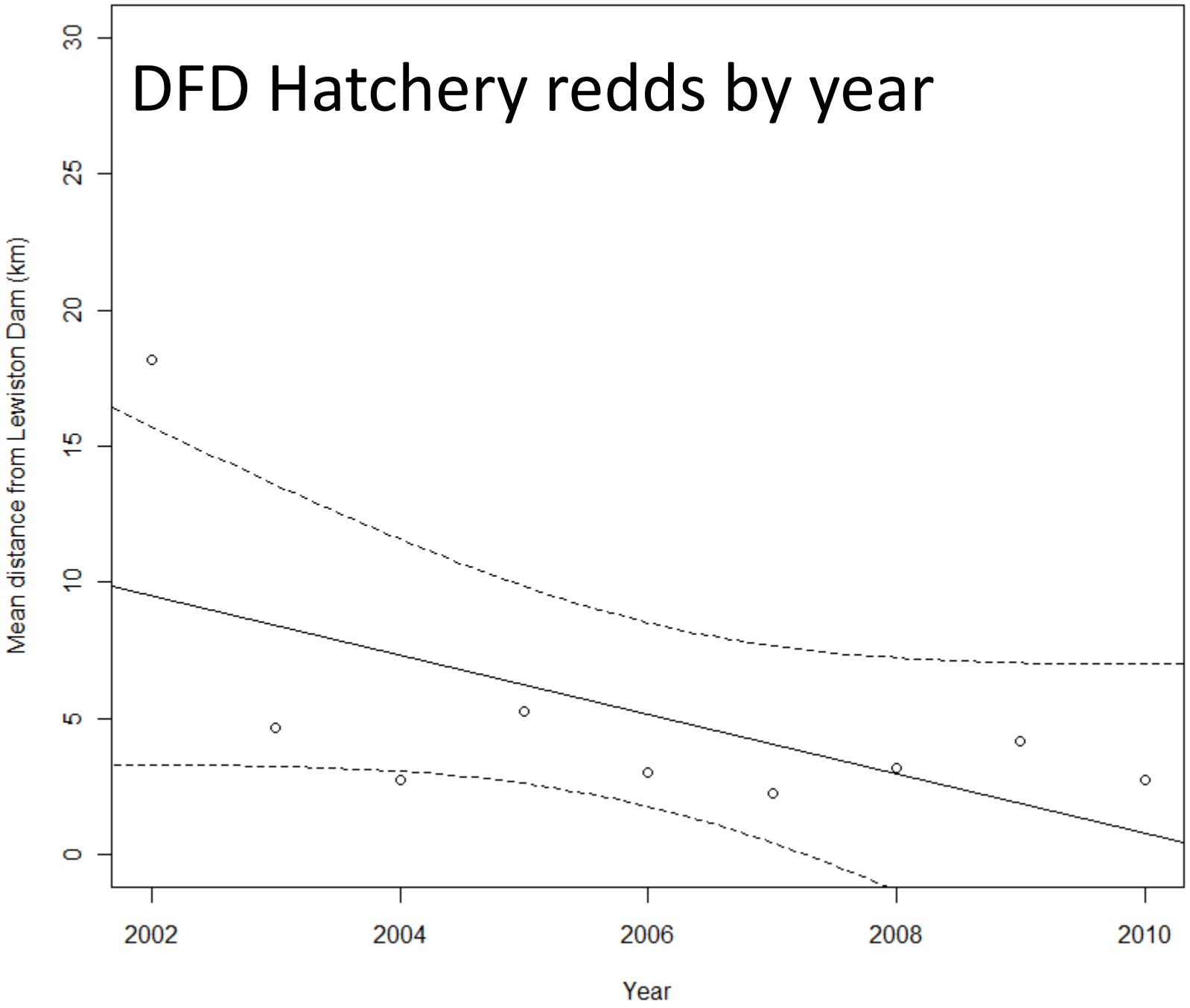

2009
Natural origin
Hatchery origin
Frequency
0
100
200
300
400
500
600
0
5
15
25
35
45
55
65
75
85
95
Distance from dam


2010
Natural origin
Hatchery origin
Frequency
0
200
400
600
800
0
5
15
25
35
45
55
65
75
85
95
Distance from dam

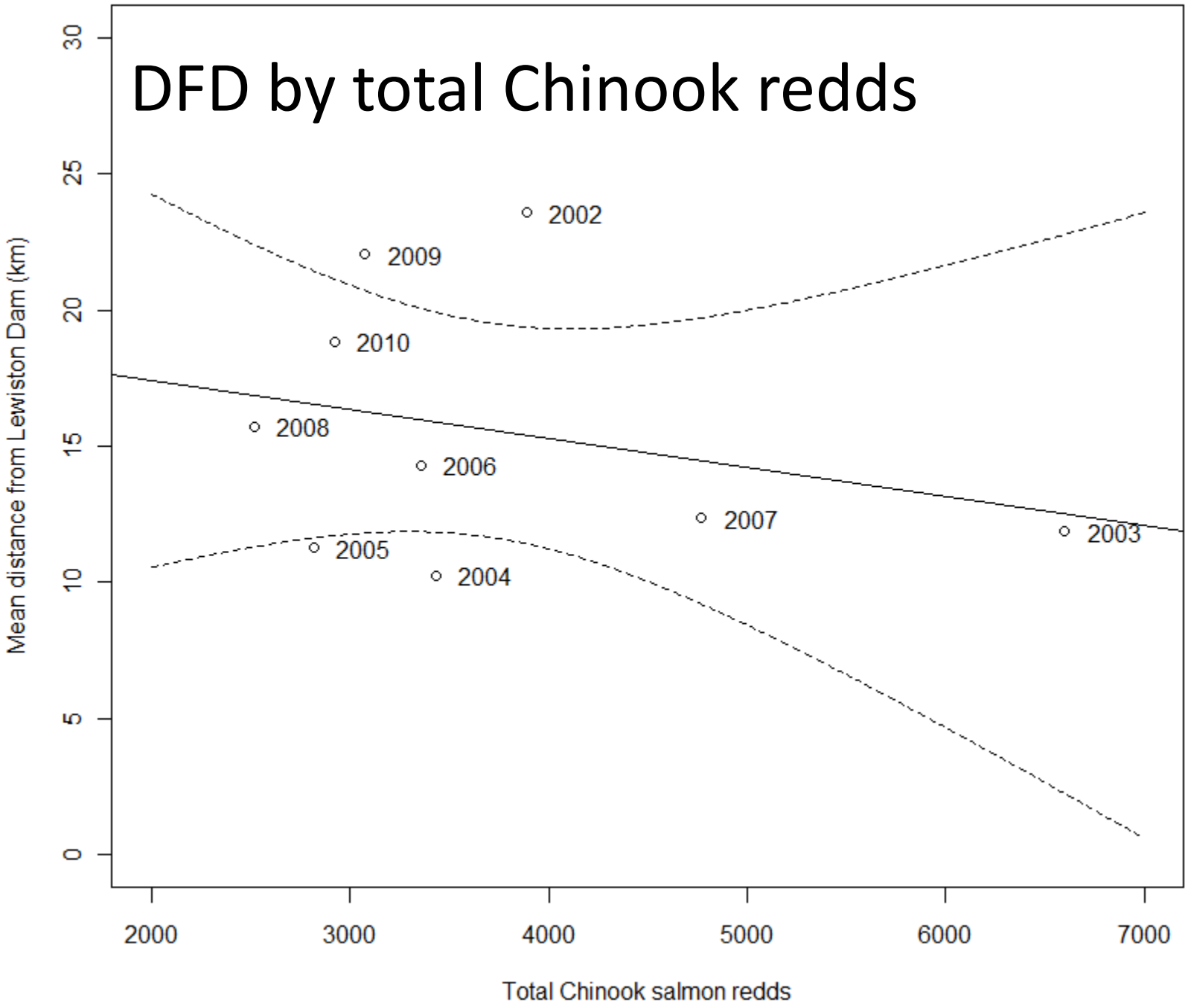
DFD Natural redds by year



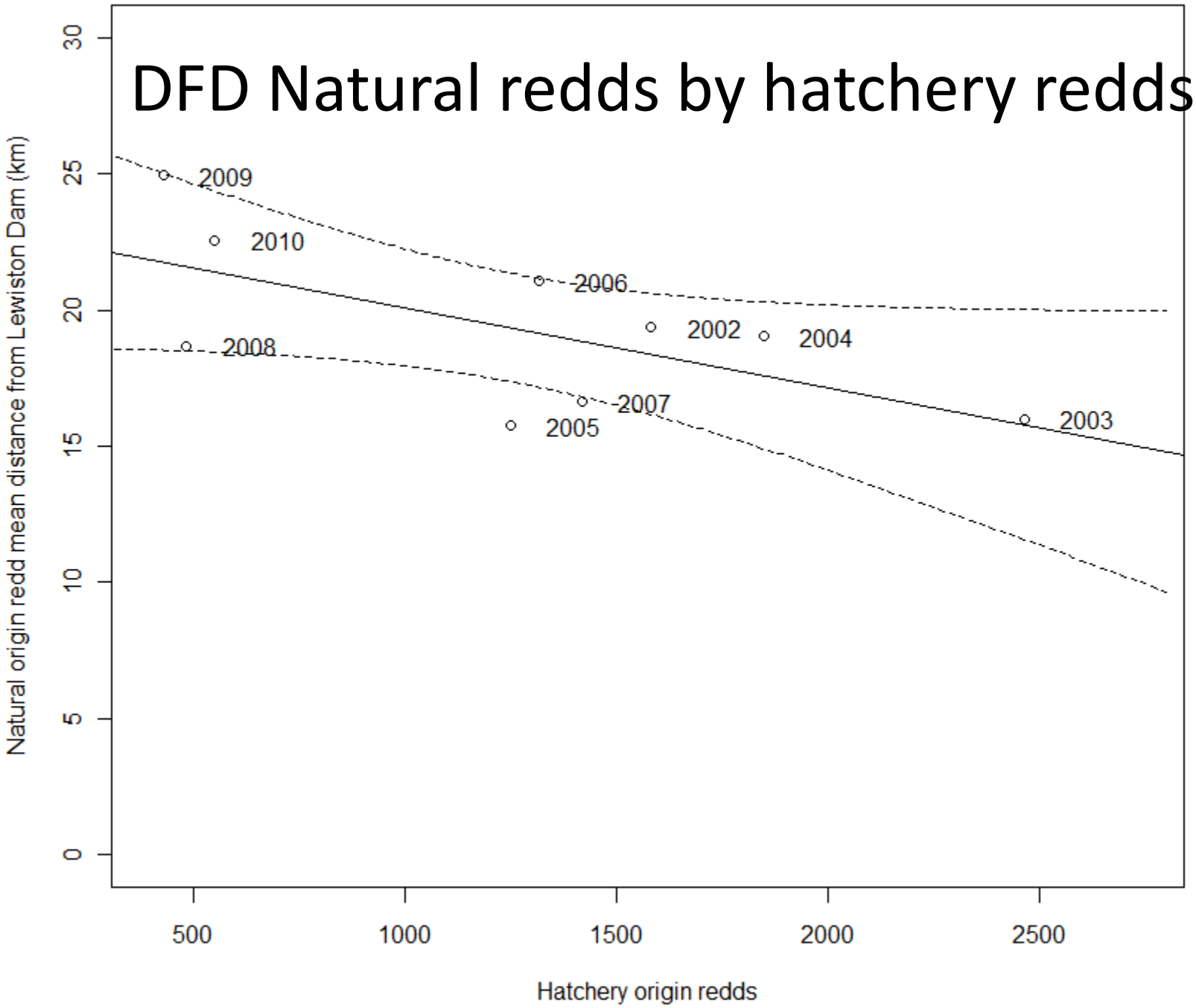
DFD Hatchery redds by year



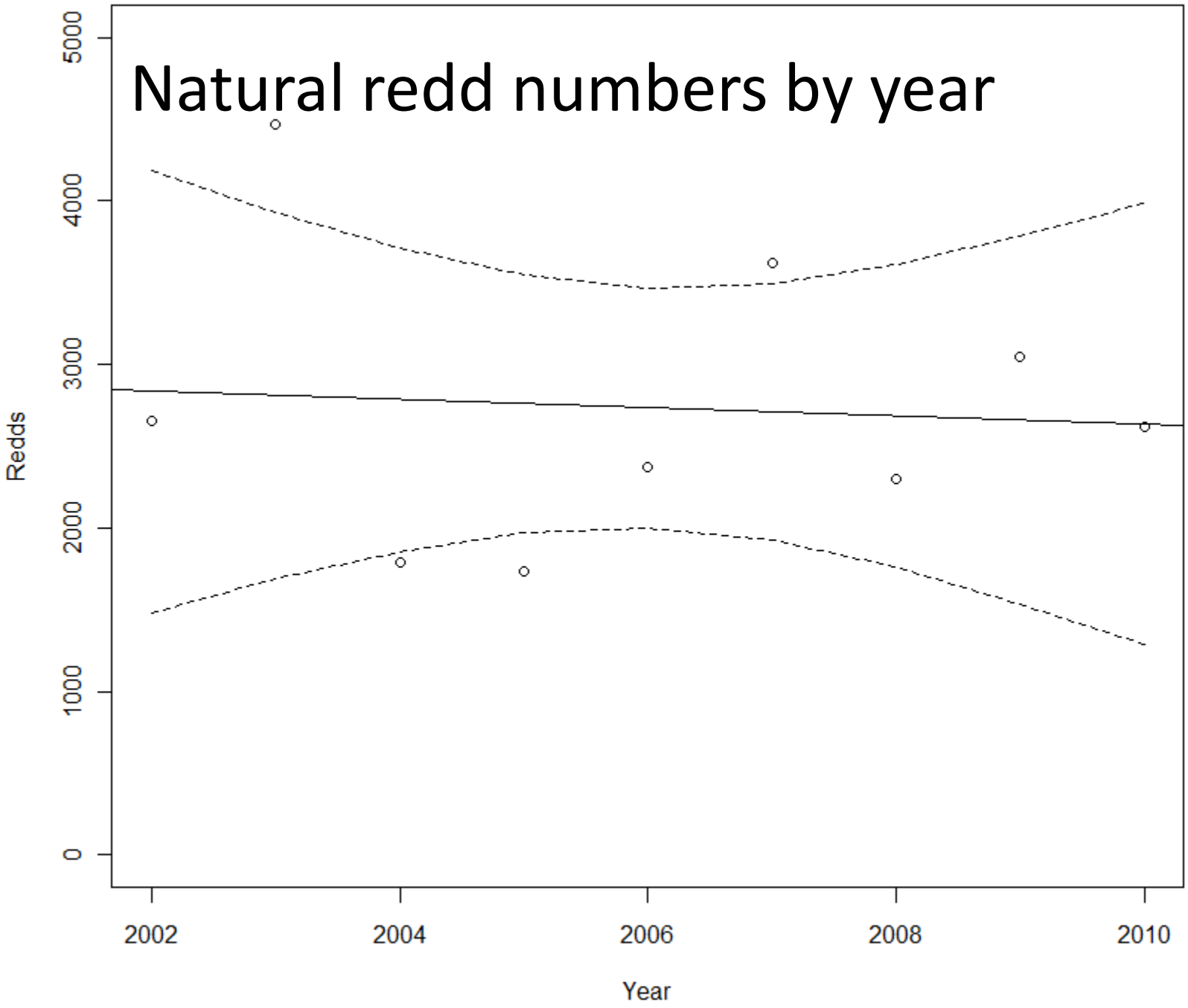
DFD by total Chinook redds



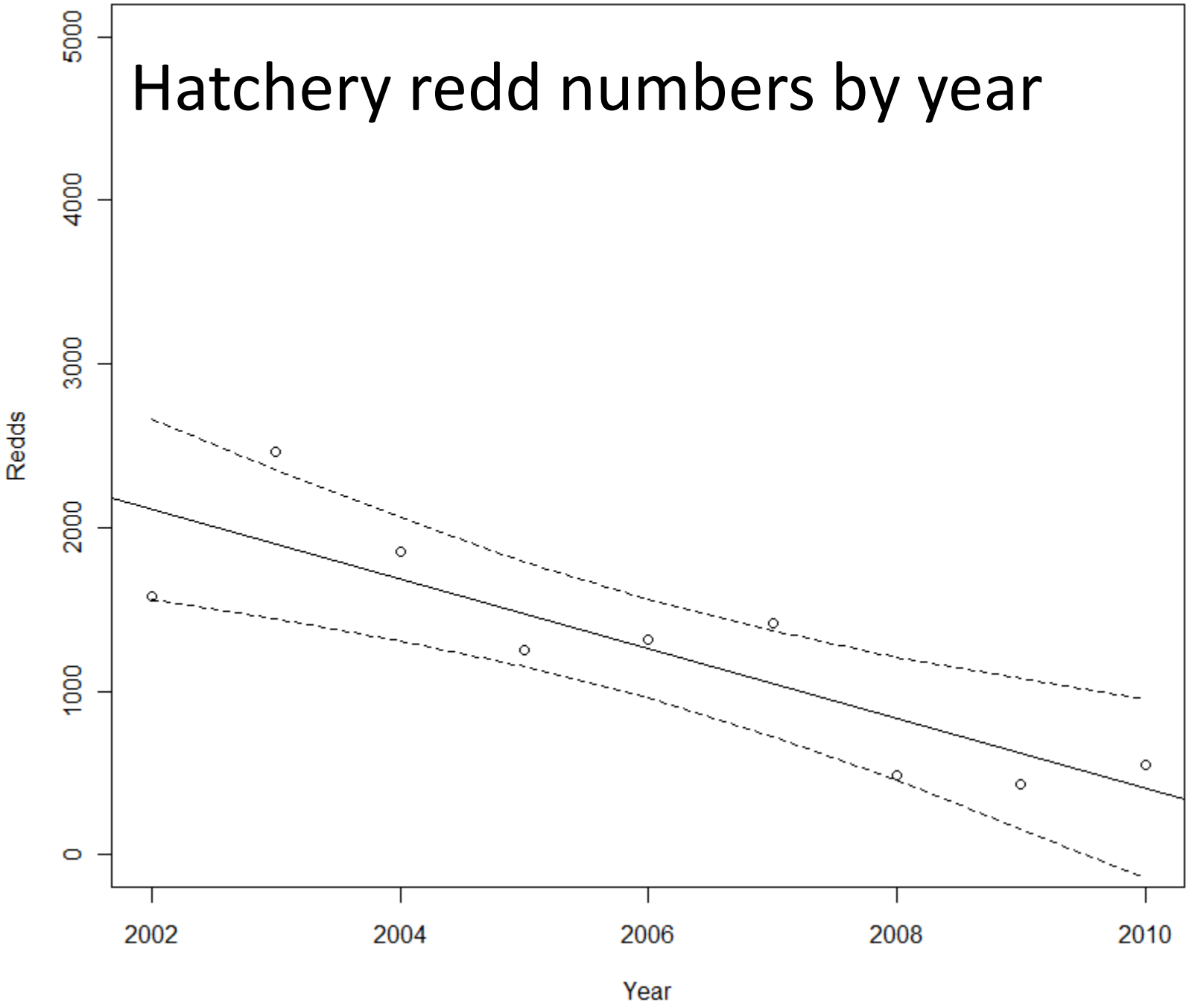
DFD Natural redds by hatchery redds



Natural redd numbers by year



Hatchery redd numbers by year



Issues/Challenges/Feedback to TRRP

3. How does this information relate to evaluating and/or recommending management actions (linking back to information presented in slide #4)
   a) Quick feedback on localized response to channel change
   b) Long-term feedback to broad-scale long-term change

References cited

Cederholm, C.J., D.B. Houston, D.L. Cole, and W.J. Scarlett. 1989. Fate of coho salmon (Oncorhynchus kisutch) carcasses in spawning streams. Canadian Journal of Fisheries and Aquatic Sciences 46:1347-1355.

Duffy, W. G. 2005. Protocols for monitoring the response of anadromous salmon and steelhead to watershed restoration in California. A draft report prepared for California Department of Fish and Game, Agreement No. P0210565. 79 pp.

Glock, J.W., H. Hartman, and Dr. L. Conquest. 1980. Skagit River chum salmon carcass drift study, City of Seattle, City Light Department. Technical Report, June 1980: 86p

Murdoch, A.R., T.N. Pearsons, and T.W. Maitland. 2009. Use of carcass recovery data in evaluating the spawning distribution and timing of spring Chinook salmon in the Chiwawa River, Washington. North American Journal of Fisheries Management 29:1206-1213.

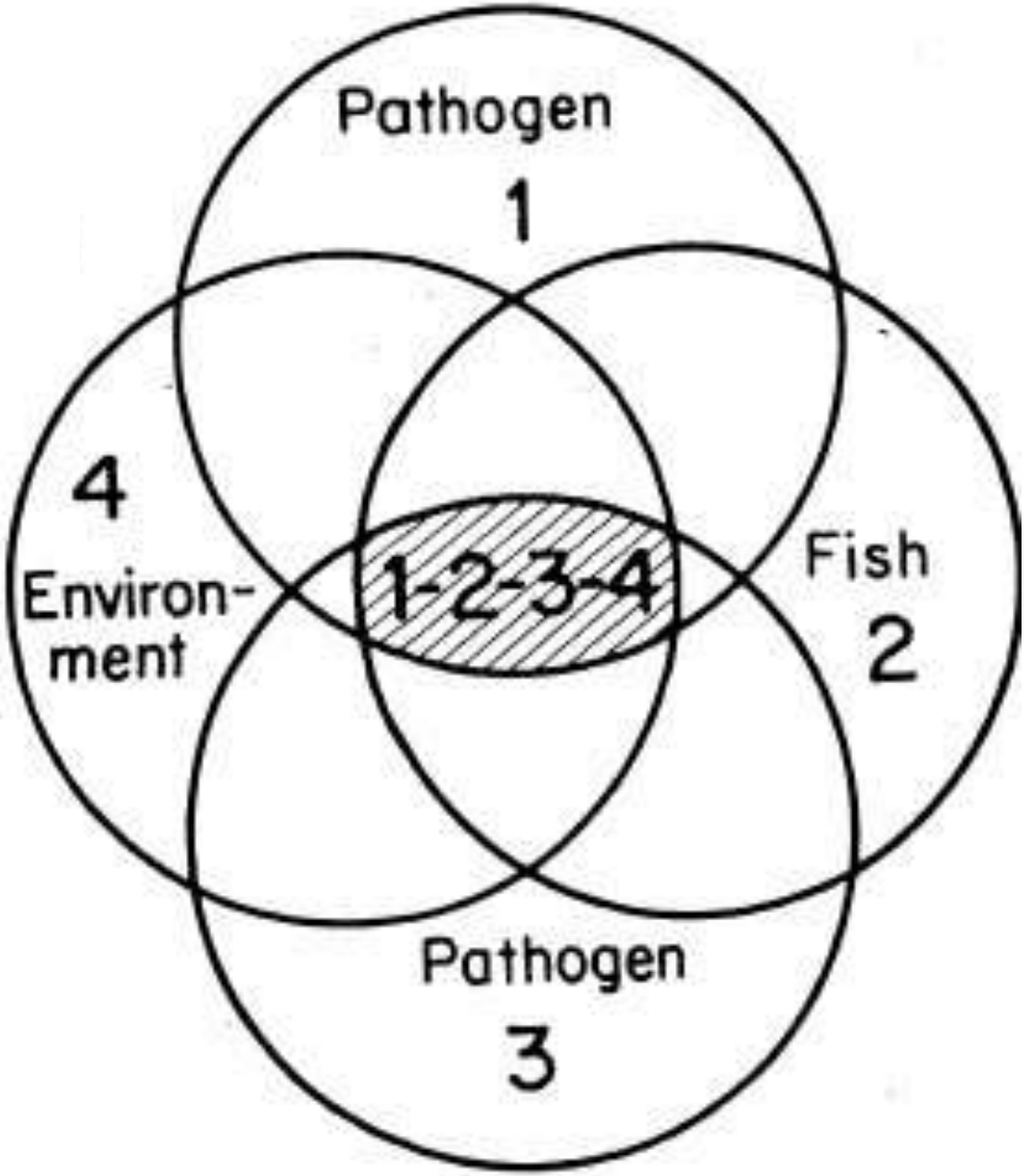
Riggers, B., S. Jacobs, and J. White. 1999. Calibration methods to survey for fall Chinook salmon in North Fork Nehalem and South Fork Coos Rivers. Annual progress report, Coastal Salmonid Inventory Project, Oregon Department of Fish and Wildlife. 23pp.

Klamath-Trinity Adult Salmon Migration and Health: Implications for Population Monitoring

Trinity River Restoration Program
Adult Monitoring Evaluation Workshop
October 26-27, 2011

Joshua Strange &
Tim Hayden
Yurok Tribal Fisheries Program

Photo: Josh Strange


Pathogen
1
4
Environ-
ment
1-2-3-4
Fish
2
Pathogen
3

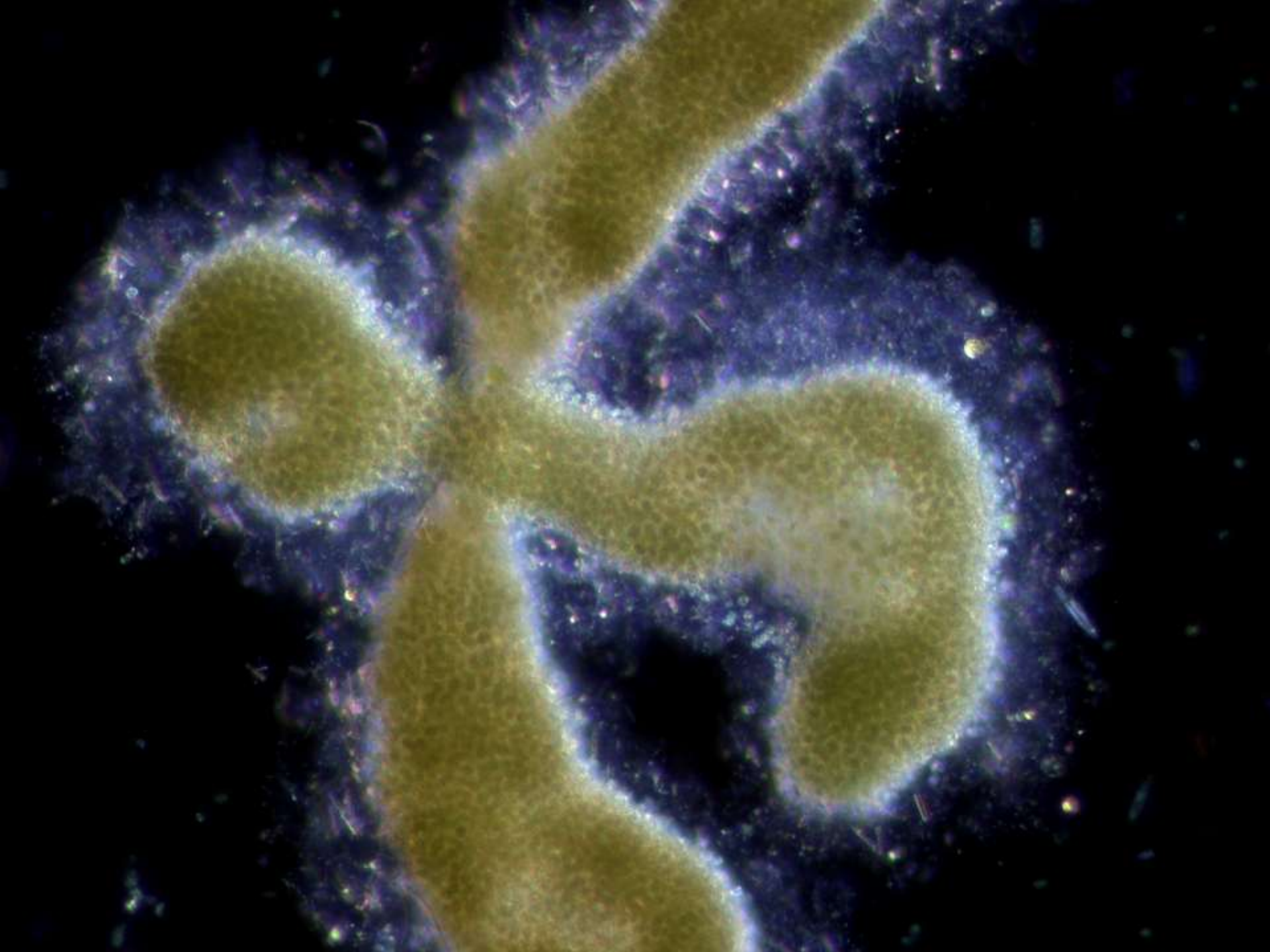



Photo: Josh Strange
Flavobactor columnare
“columnaris”

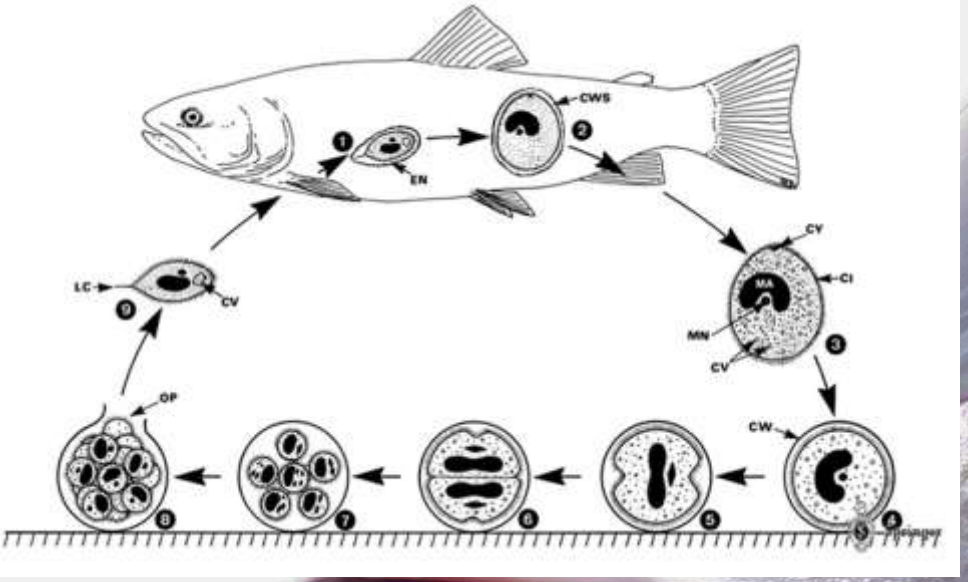
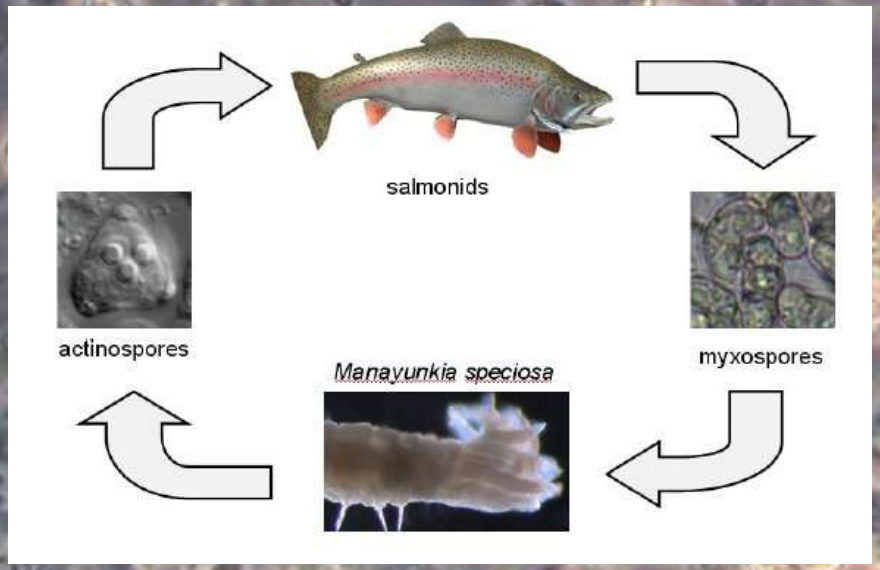
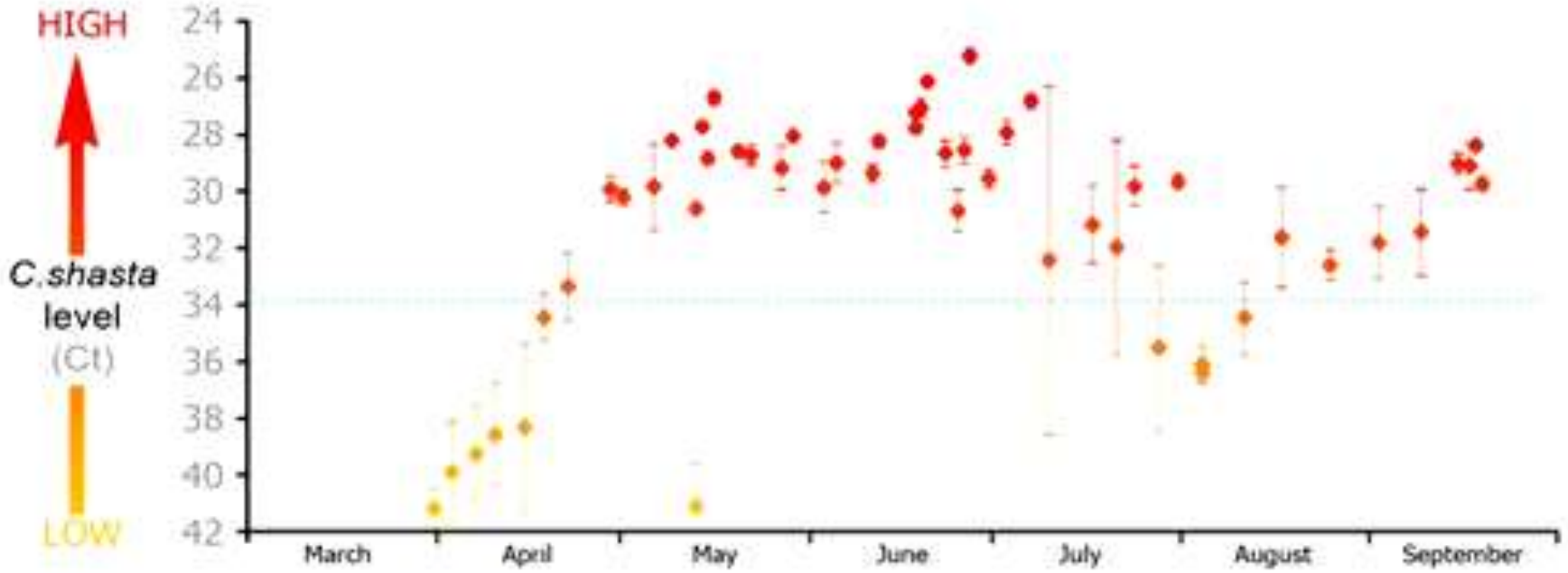


Photo: Mike Belchik

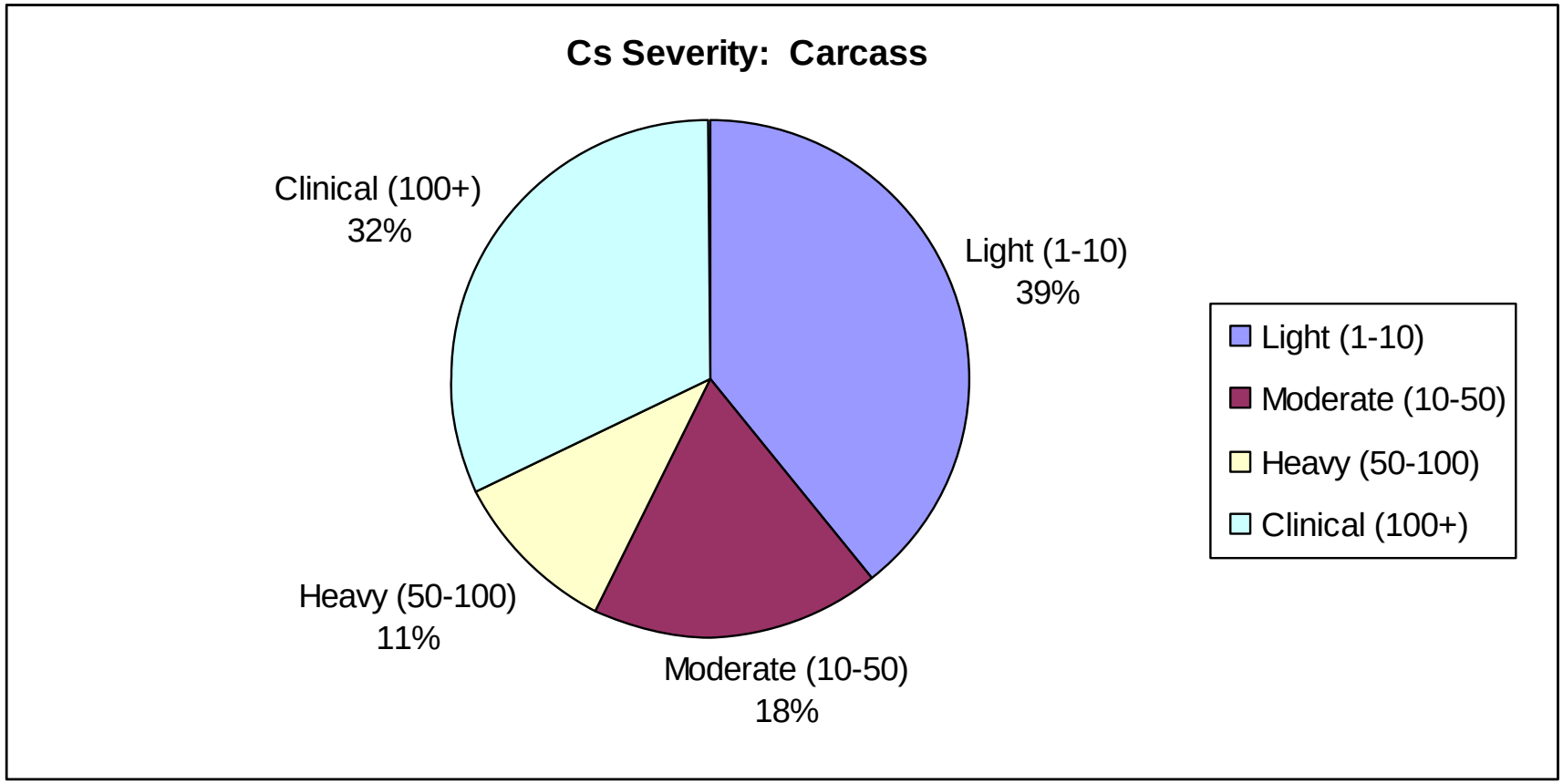
Ichthyopthirius multifilis

"ICH"

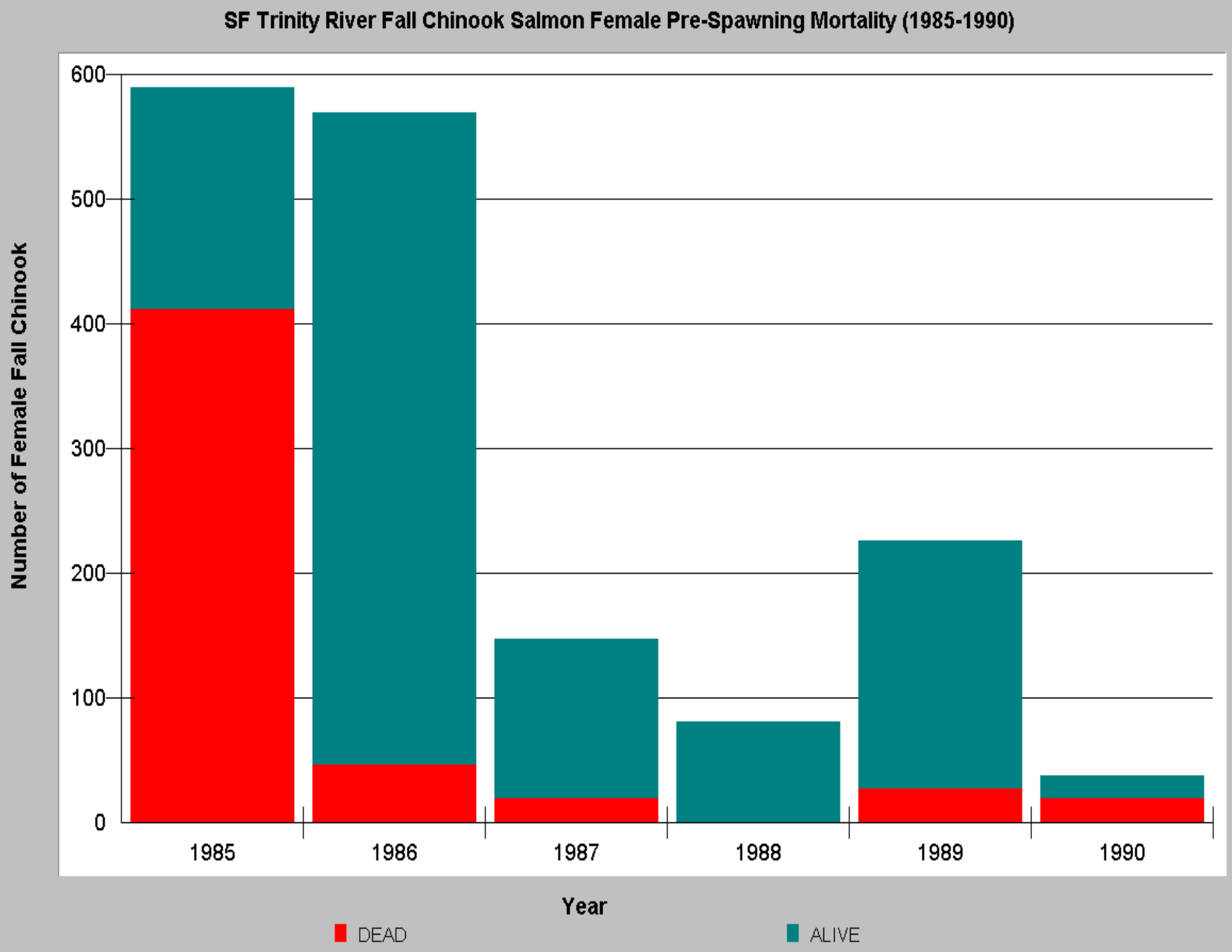

salmonids
myxospores
Manayunkia speciosa
actinospores

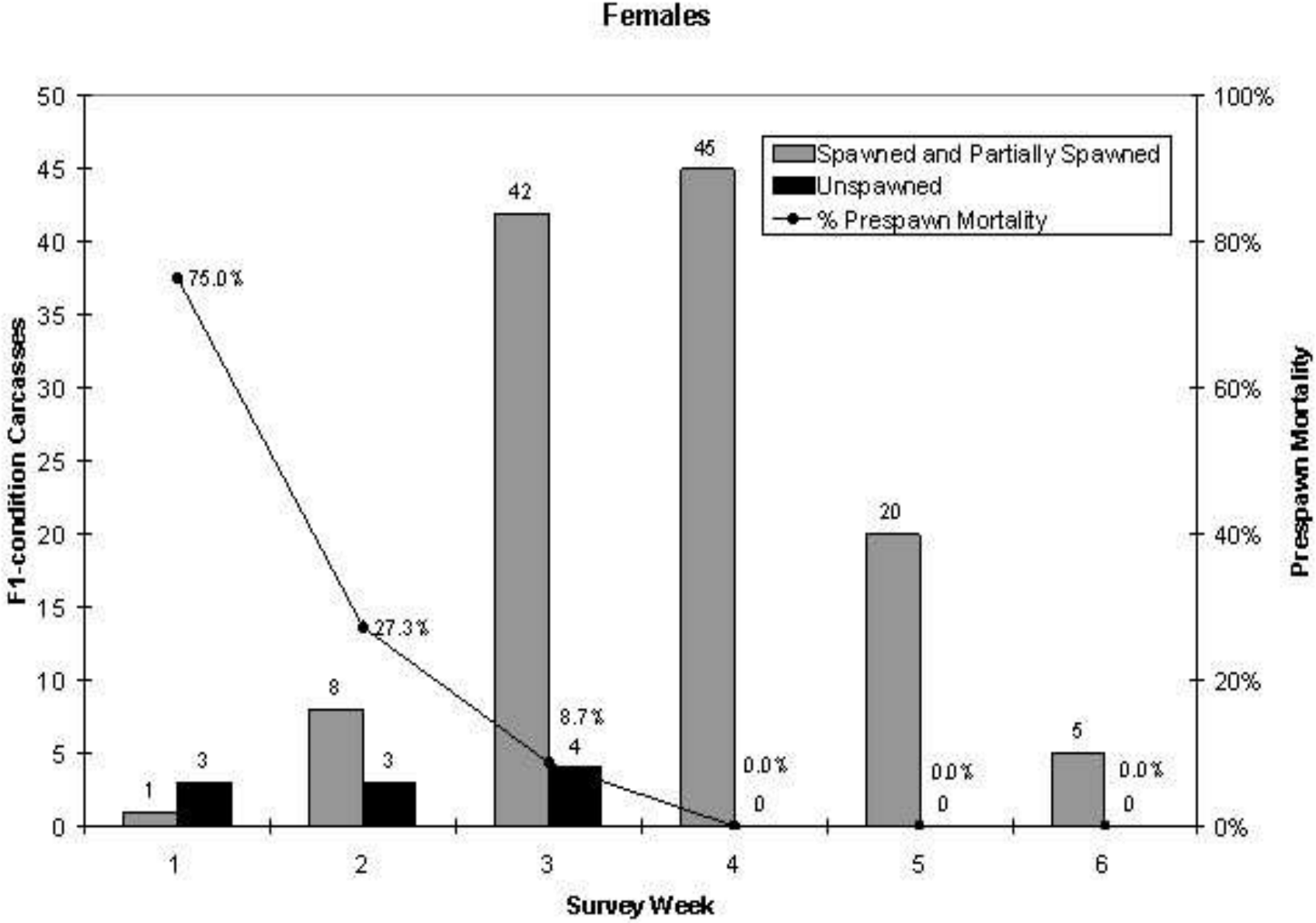

HIGH
C.shasta
level
(Ct)
LOW
24
26
28
30
32
34
36
38
40
42
March
April
May
June
July
August
September

Results



28 Positive Samples


SF Trinity River Fall Chinook Salmon Female Pre-Spawning Mortality (1985-1990)
Number of Female Fall Chinook
600
500
400
300
200
100
0
1985
1986
1987
1988
1989
1990
Year
DEAD
ALIVE


Females
F1-condition Carcasses
Prespawn Mortality
Survey Week
Spawned and Partially Spawned
Unspawned
% Prespawn Mortality
50
45
40
35
30
25
20
15
10
5
0
100%
80%
60%
40%
20%
0%
1
2
3
4
5
6
75.0%
27.3%
8.7%
0.0%
0.0%
0.0%
1
3
8
3
42
4
45
0
20
0
5
0

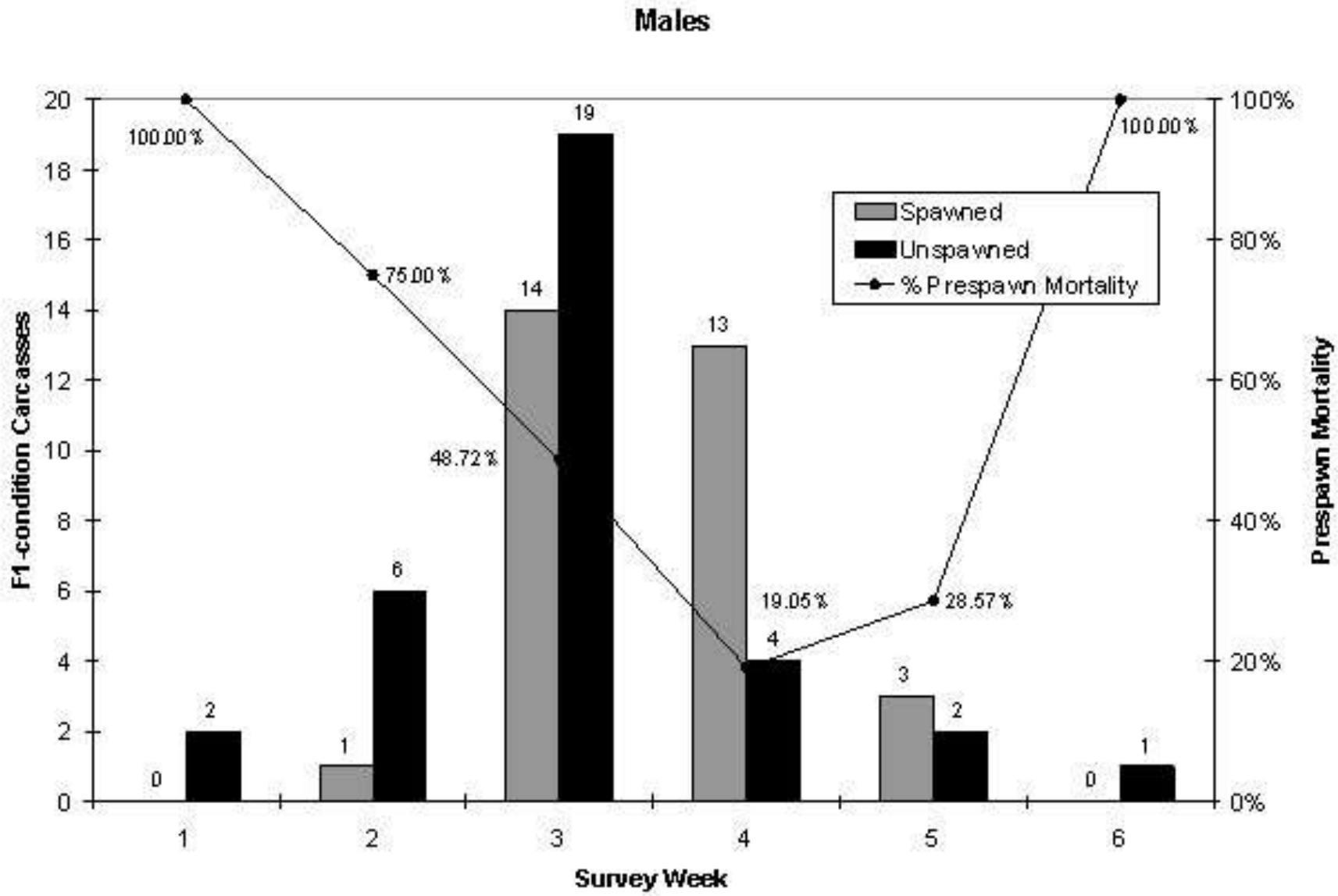

Males
F1-condition Carcasses
Prespawn Mortality
Survey Week
Spawned
Unspawned
% Prespawn Mortality
100.00%
75.00%
48.72%
19.05%
28.57%
100.00%
0
2
1
6
14
19
13
4
3
2
0
1
1
2
3
4
5
6
0%
20%
40%
60%
80%
100%


Photo: Josh Strange


Photo: Mike Belchik

Adult Fall-Run Chinook Salmon Pathology Monitoring – 2003 to 2011

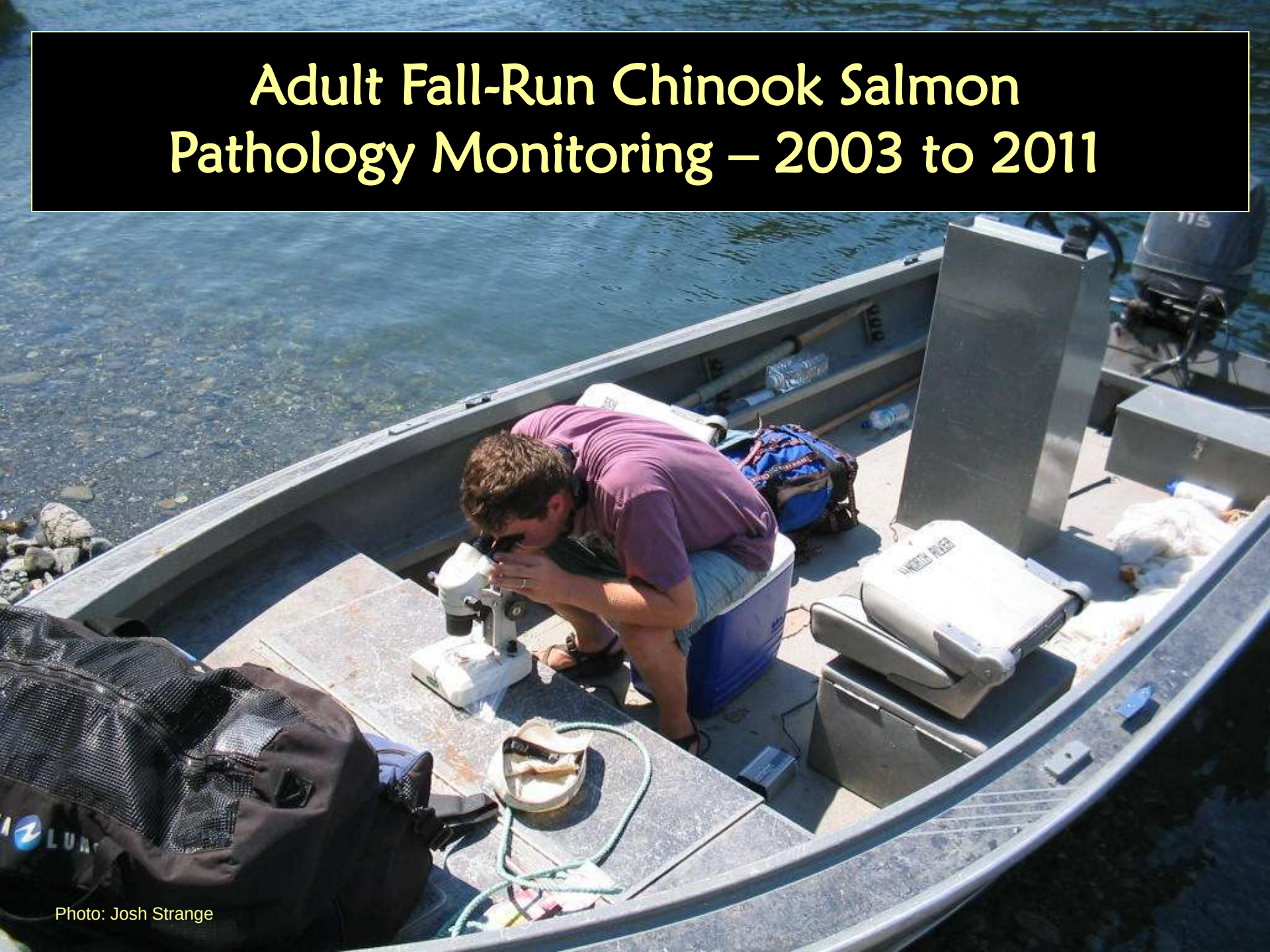
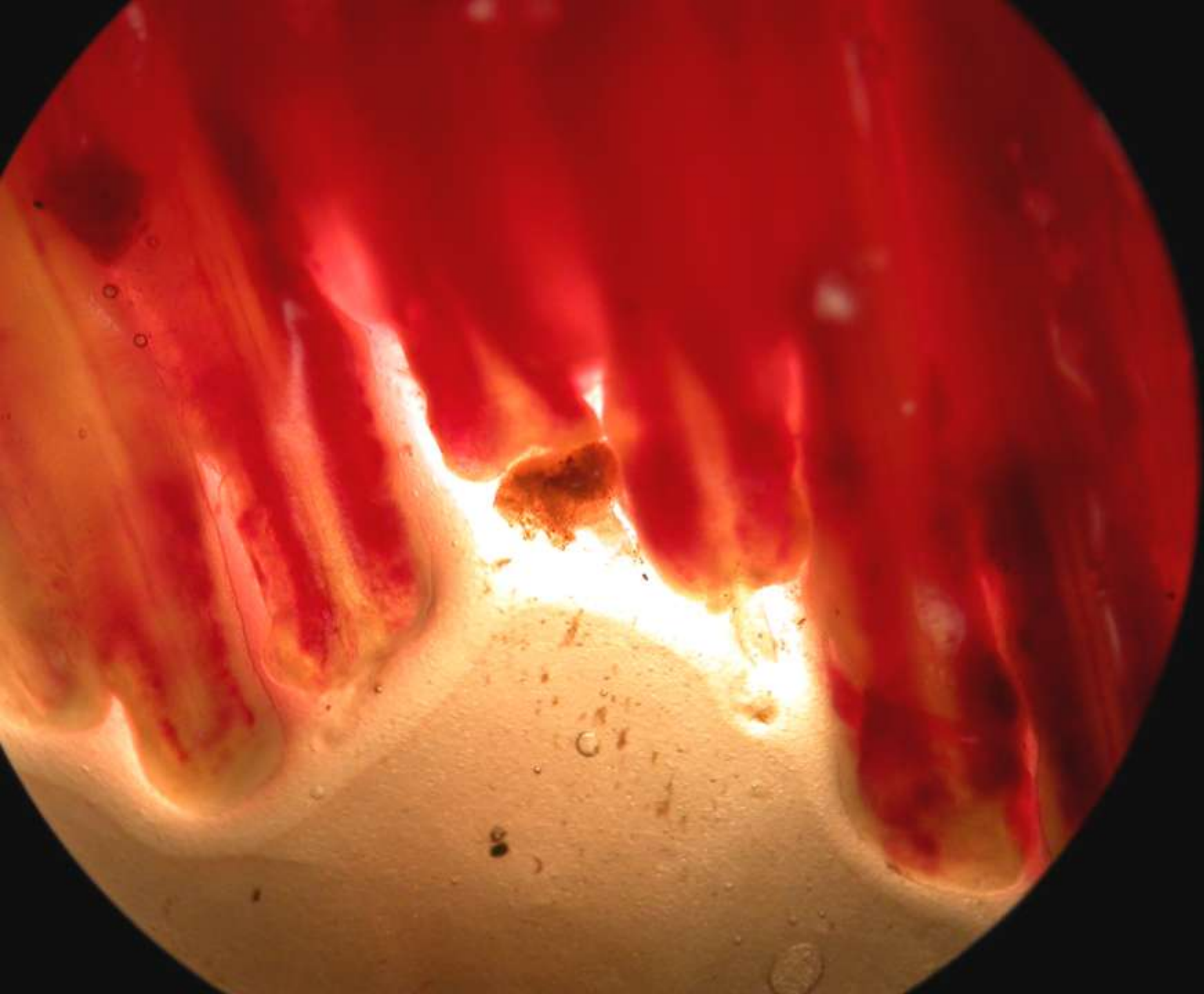


Photo: Josh Strange



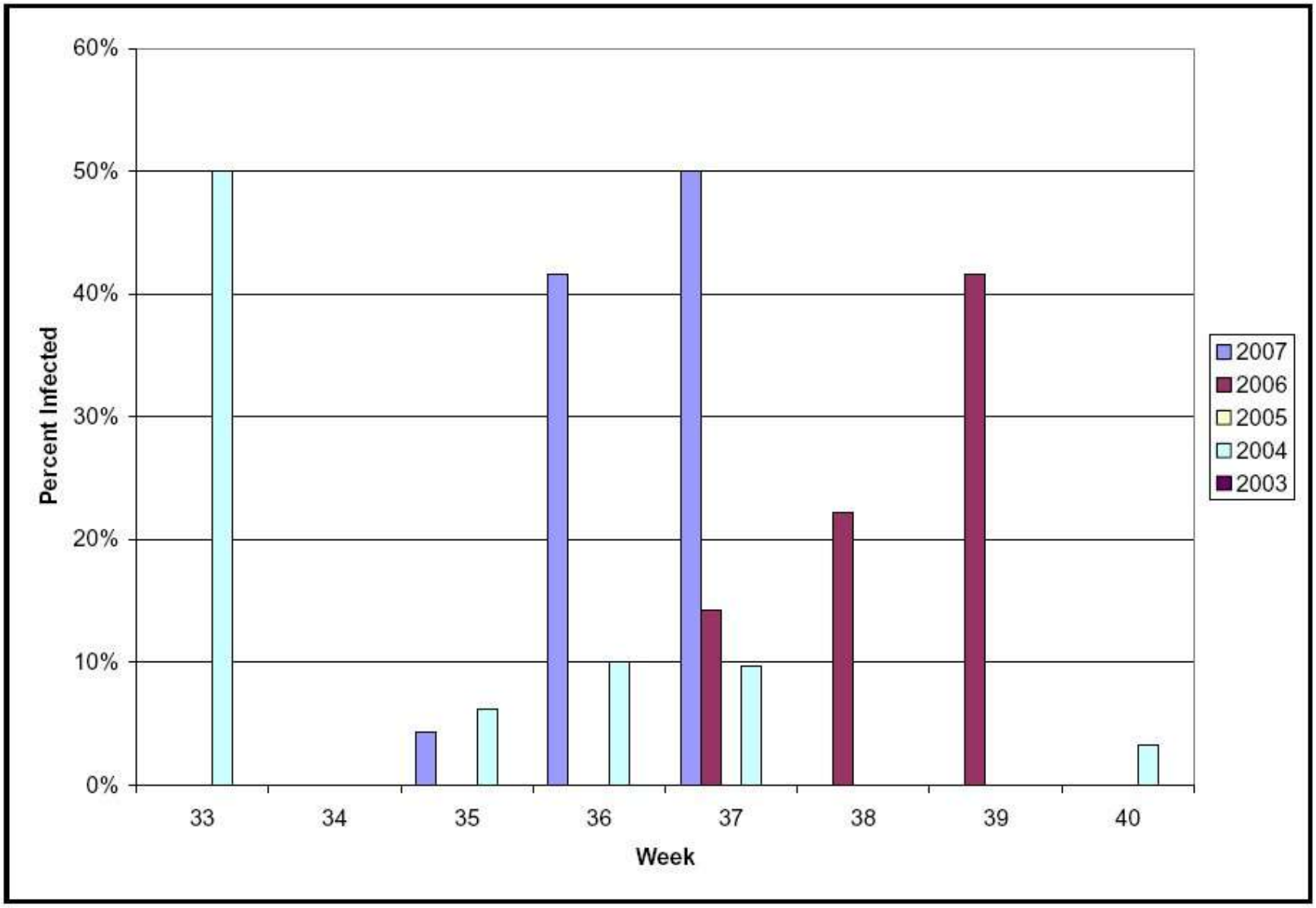


Figure 4: Percent of adult Chinook salmon infected with columnaris during YTFP pathology study from 2003 to 2007. Week refers to the week of the year starting from January 1st.

"ICH"

2011: low incidence, low severity, no mortality

2010: low incidence, low severity, no mortality

2009: low incidence, low severity, no mortality

2008: low incidence, low severity, no mortality

2007: low incidence, low severity, no mortality

2006: low incidence, low severity, no mortality

2005: low incidence, low severity, no mortality

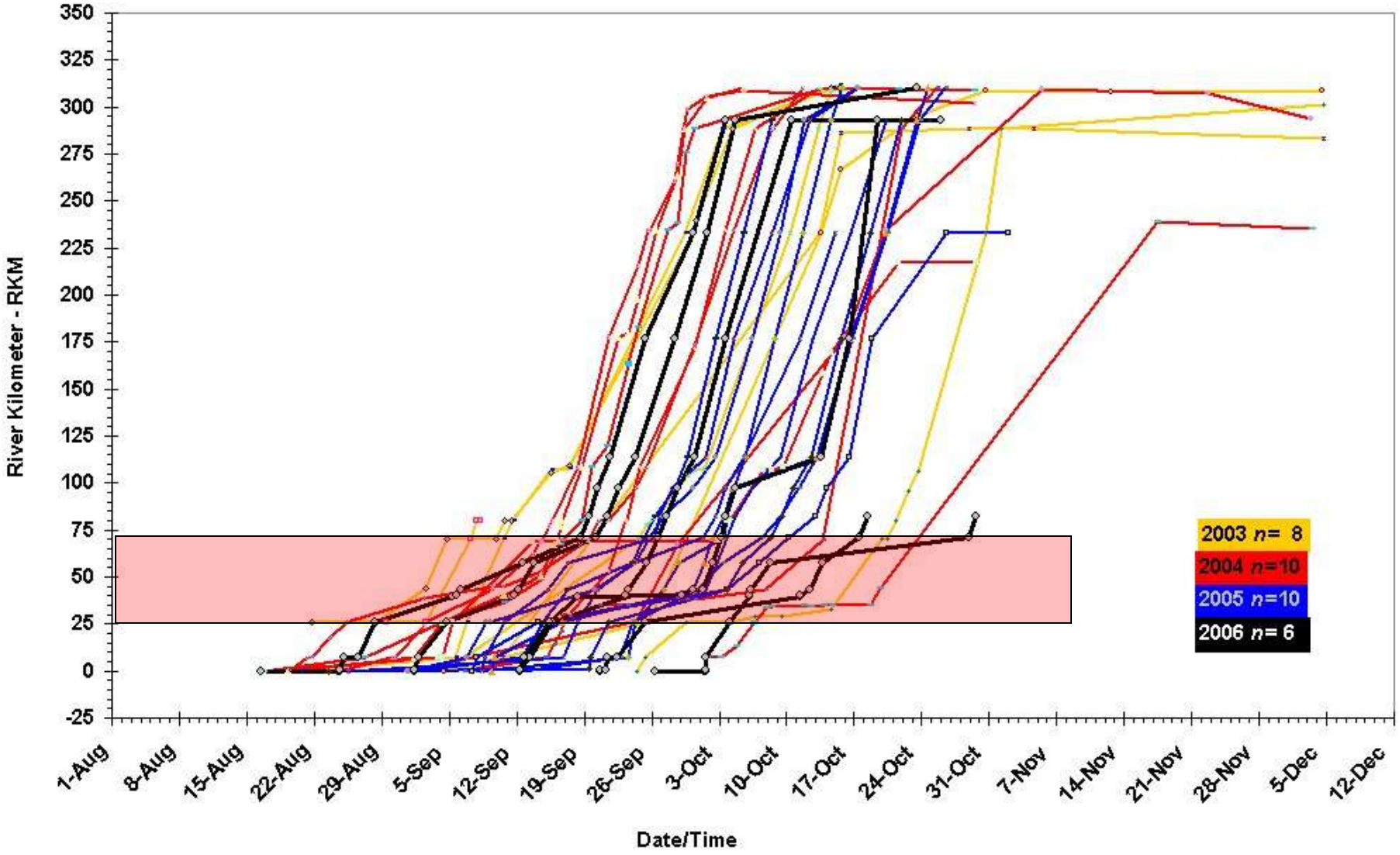
2004: low incidence, low severity, no mortality

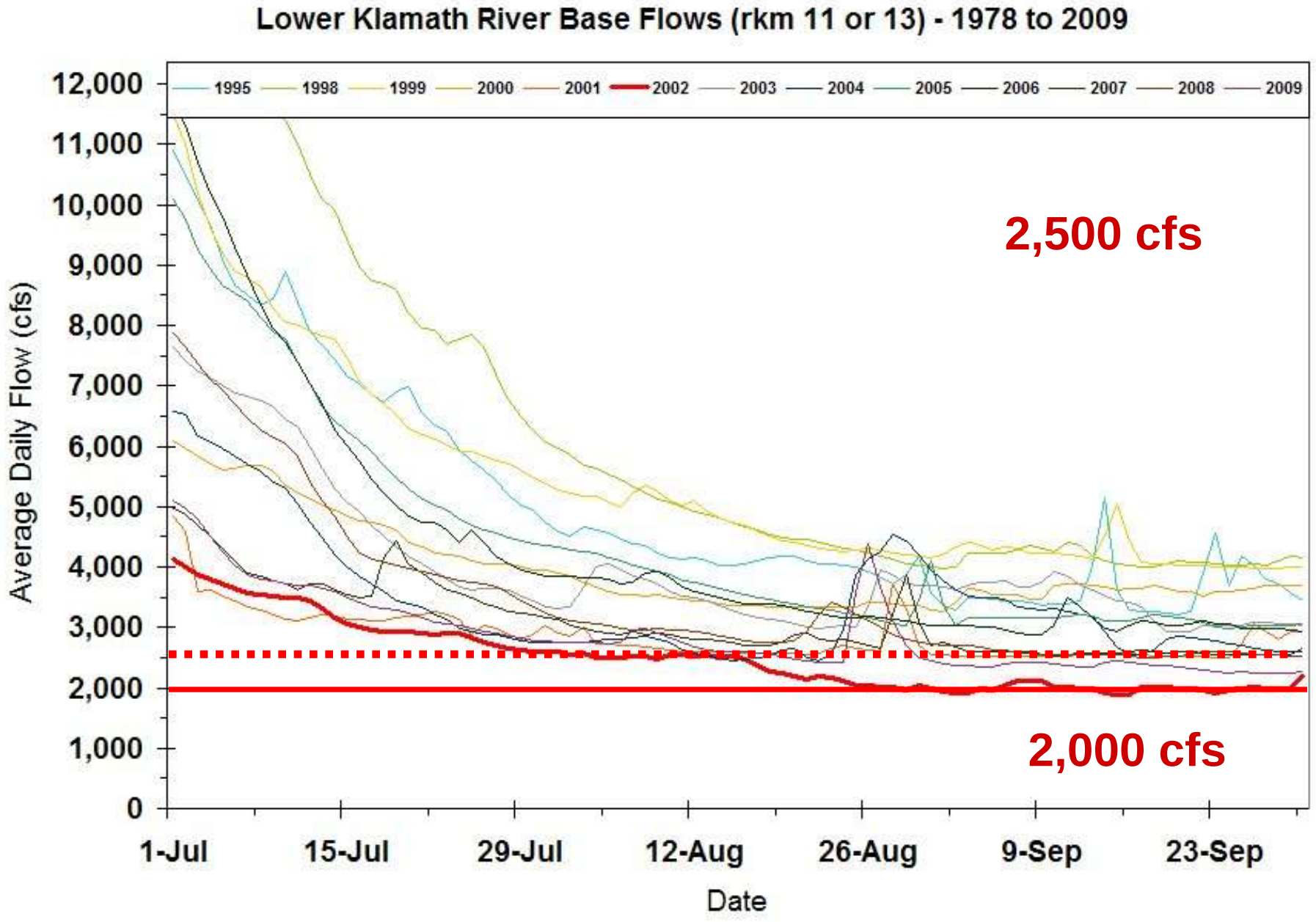
2003: moderate incidence, low severity, no mortality

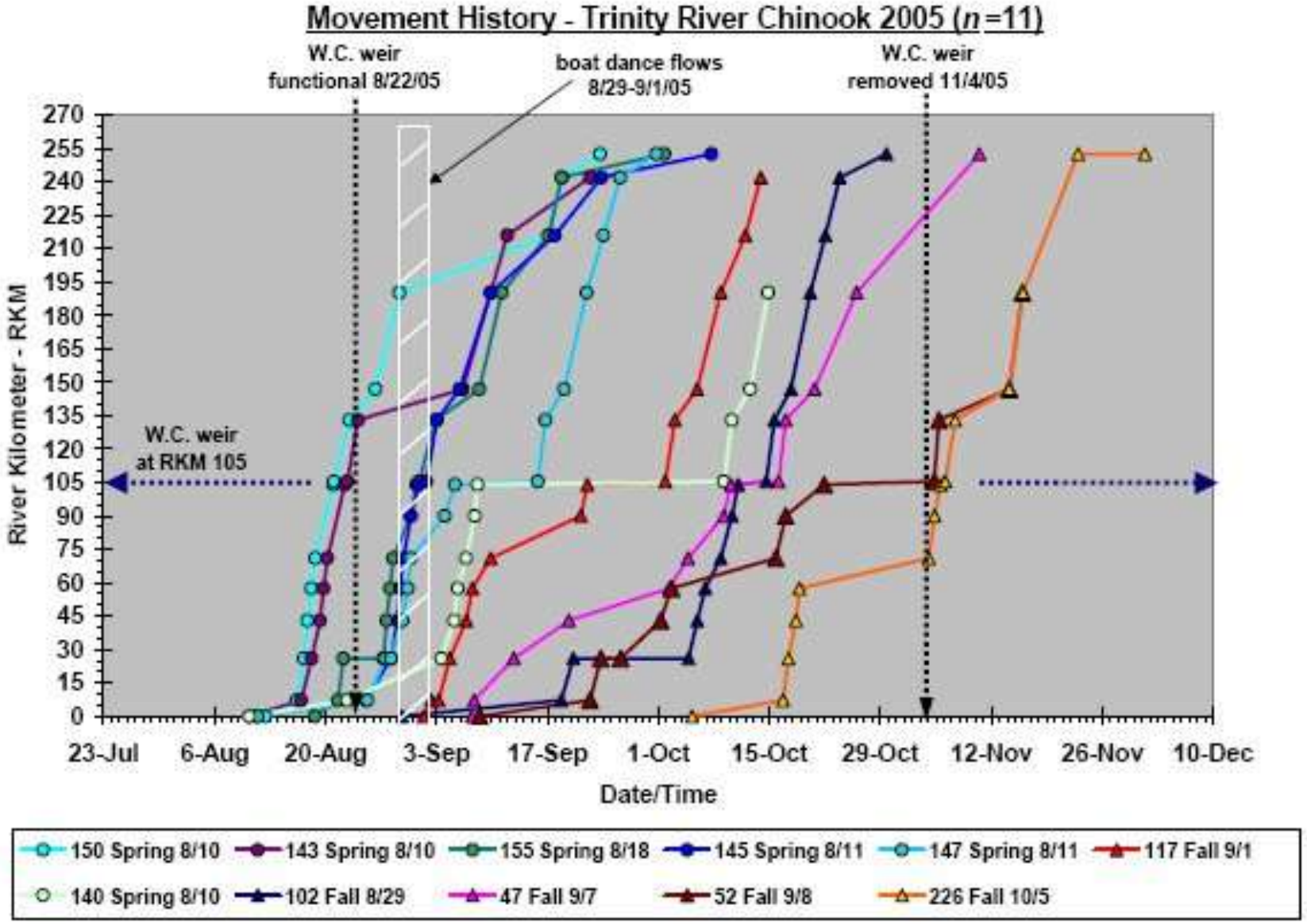
2002: high incidence, high severity, mass mortality

Photo: Mike Belchik

Movement Histories for Klamath Fall Chinook Migrants - 2003 to 2006




Lower Klamath River Base Flows (rkm 11 or 13) - 1978 to 2009
1995
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
12,000
11,000
10,000
9,000
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0
Average Daily Flow (cfs)
2,500 cfs
2,000 cfs
1-Jul
15-Jul
29-Jul
12-Aug
26-Aug
9-Sep
23-Sep
Date


Movement History - Trinity River Chinook 2005 (n=11)
W.C. weir functional 8/22/05
boat dance flows 8/29-9/1/05
W.C. weir removed 11/4/05
W.C. weir at RKM 105
River Kilometer - RKM
270
255
240
225
210
195
180
165
150
135
120
105
90
75
60
45
30
15
0
23-Jul
6-Aug
20-Aug
3-Sep
17-Sep
1-Oct
15-Oct
29-Oct
12-Nov
26-Nov
10-Dec
Date/Time
150 Spring 8/10
143 Spring 8/10
155 Spring 8/18
145 Spring 8/11
147 Spring 8/11
117 Fall 9/1
140 Spring 8/10
102 Fall 8/29
47 Fall 9/7
52 Fall 9/8
226 Fall 10/5

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