
Photo: Yurok Tribe


Photo: CDFG


Photo: FWS

TRRP Adult Salmonid Monitoring Evaluation

Draft Recommendations


Photo: CDFG


Photo: CDFG


Photo: FWS


Photo: Yurok Tribe


Photo: CDFG


Photo: Yurok Tribe

Trinity River Restoration Program

Work Shop

February 17, 2012

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.

Trinity River Restoration Program's Adult Salmonid Monitoring Evaluation - timeline

- October - December 2010 - TRRP Fish WG develops draft SOW for subprogram review of TRRP adult salmonid monitoring assessments and projects.
- January 2011 – SOW finalized by Fish WG.
- June 2011 – contract awarded
- October 2011 - Project Presentations Workshop
- February 3, 2012 - Draft Report Delivered

- February 17, 2012 - Draft Report Presentation
- February 22, 2012 - Comments on Draft Due
- March 15, 2012 - Final Report Delivery

Trinity River Restoration Program's Adult Salmonid Monitoring Evaluation

Draft Agenda:

Time	Topic	Presenter
9:00	Introduction / agenda review and finalization	J. Polos
9:15	Presentation of draft findings.	M. Bradford & D. Hankin
11:00	Q&A	Group
12:30	Lunch – get something to bring back to the meeting	
1:00	Q&A continued	Group
2:00	Wrap-Up/Action item review	J. Polos
2:30	Adjourn	

Trinity River Restoration Program Adult Salmonid Monitoring Evaluation

First Review Draft

Dr Mike Bradford
Simon Fraser University

Dr David Hankin
Humboldt State University

For internal review purposes only, do not circulate.

Trinity River adult salmon review draft discussion

Mike Bradford

Dave Hankin

Feb 17, 2012

Project timelines

- Fall 2011- Document review
- October 2011- workshop
- February 2012- draft discussion
- March 2012- final draft

Documents reviewed:

Reports

•U.S. Department of the Interior Record of Decision, Trinity Mainstem Fishery Restoration Final Environmental Impact Statement/Environmental Impact Report, December 2000.
•Trinity River Flow Evaluation Final Report, U.S. Fish and Wildlife Service and Hoopa Valley Tribe, June 1999. 308 pages.
•Trinity River Restoration Program, Integrated Assessment Plan (Part 1) Version 1.0, 2009.
•Trinity River Restoration Program, Conceptual Models and Hypotheses for the Trinity River Restoration Program, January 5, 2006 draft.
•CDFG run size report
•KRTAT fall Chinook salmon age composition report
•Redd/carcass survey reports
•Tribal harvest reports
•Sport harvest reports for the lower Klamath River
•Adult fish health reports
•Adult Chinook salmon migration Reports
•Coded Wire Tagging/Constant Fractional Marking at Trinity River Hatchery (Hankin and Newman, 1996)
•TRRP adult monitoring review (Hankin 2001)

Project Proposals (and reviews) for Federal Fiscal Year 2012

•Run Size and harvest (Junction City and Willow Ck Weirs and Hatchery recovery project)
•Harvest –
    ▪Hoopa
    ▪Yurok
    ▪Lower Klamath recreational
    ▪Lower Trinity recreational
•Age Composition
•Redd/Carcass Survey
•Coded Wire Tagging
•CWT recovery/decoding
•Adult fish health

You are not alone!

Ecological Applications, 21(6), 2011, pp. 1926–1931

River restoration: the fuzzy logic of repairing reaches to reverse catchment scale degradation

EMILY S. BERNHARDT[1,4] AND MARGARET A. PALMER[2,3]

River restoration is hard to do, and even harder to evaluate!

Restoration Ecology
THE JOURNAL OF THE SOCIETY FOR ECOLOGICAL RESTORATION INTERNATIONAL

RESEARCH ARTICLE

Resizing a River: A Downscaled, Seasonal Flow Regime Promotes Riparian Restoration

Alexis A. Hall,[1,2] Stewart B. Rood,[1,3] and Paul S. Higgins[4]

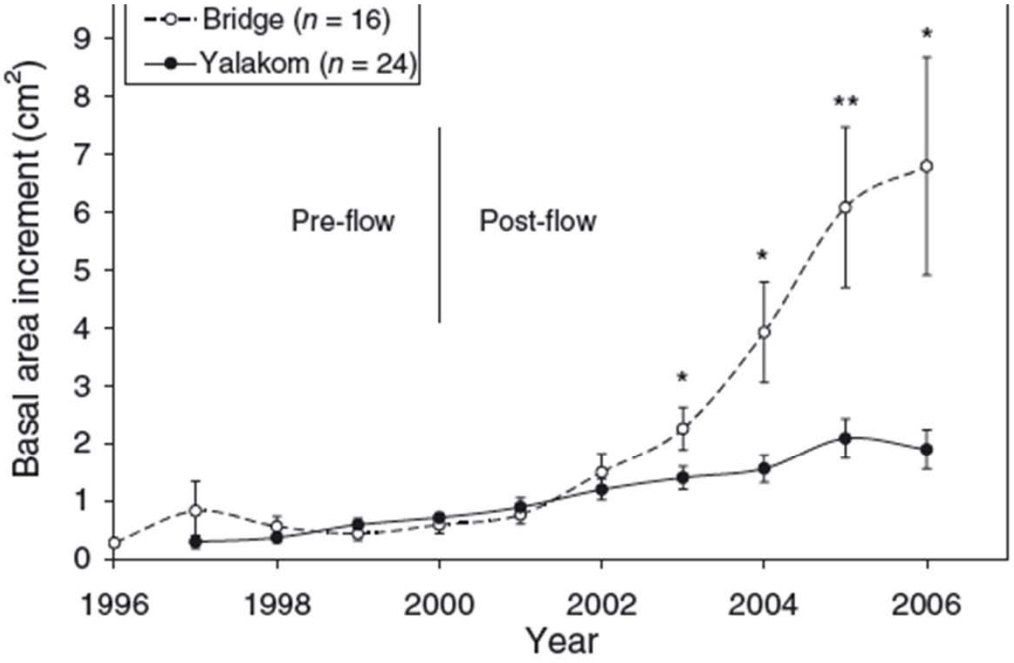


Figure 7. Average (±SD) basal area increments of juvenile cottonwoods along Lower Bridge River Reach 4 and Yalakom River, during pre- and post-flow intervals. *, ** = significant difference at $p<0.05$ and $p<0.01$, respectively, as detected by t-tests.

Freshwater Biology

Freshwater Biology (2011) doi:10.1111/j.1365-2427.2011.02633.x

APPLIED ISSUES

Test of an environmental flow release in a British Columbia river: does more water mean more fish?

MICHAEL J. BRADFORD*, PAUL S. HIGGINS†, JOSH KORMAN‡ AND JEFF SNEEP§

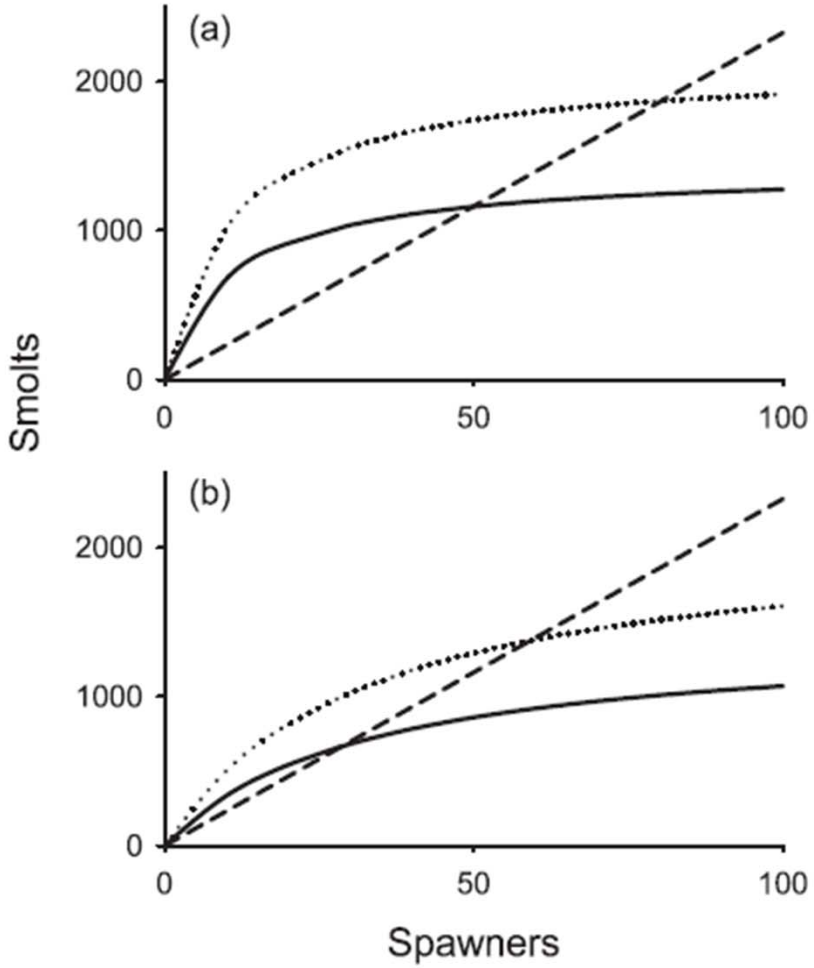
0.3 m^3s^{-1}

3 m^3s^{-1}

16 m^3s^{-1}

Using confidence intervals to estimate the response of salmon populations (*Oncorhynchus* spp.) to experimental habitat alterations

Michael J. Bradford, Josh Korman, and Paul S. Higgins



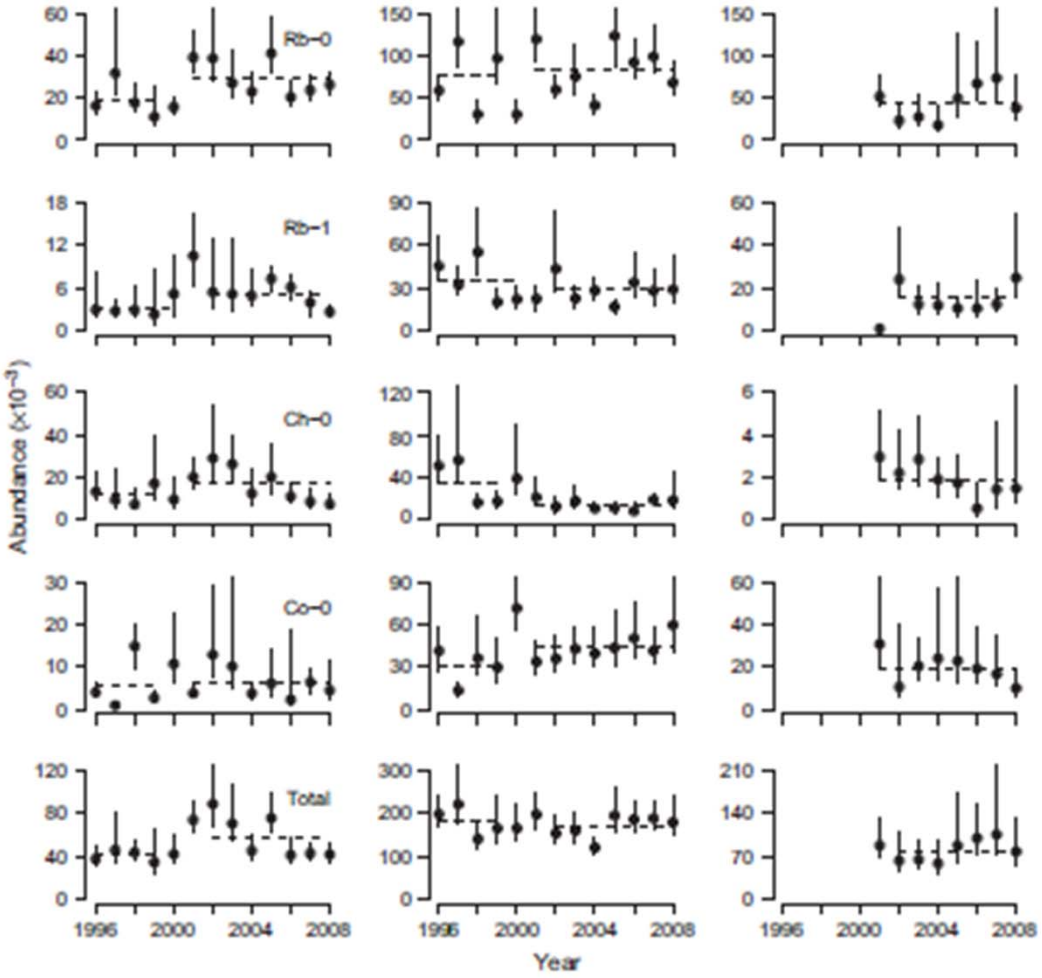


Fig. 7 Annual estimates of abundance of four salmon taxa and their total for three reaches of the Bridge River. From left to right, data are for Reaches 2, 3 and 4. Vertical lines are 95% credible intervals from the hierarchical Bayesian model. Dashed lines are the median abundance before and after the flow release.

Objective 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

- **Objective 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
- **Objective 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
- **Objective 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 salmon adult salmon adults
- **Objective 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

Objective 3: Restore and maintain natural production of anadromous fish populations

- 3.1: Increase spawning, incubation and emergence success of anadromous spawners
- 3.2: Increase freshwater production of anadromous fish
- 3.3: Minimize impacts of predation and genetic interactions between and among hatchery and natural anadromous fish

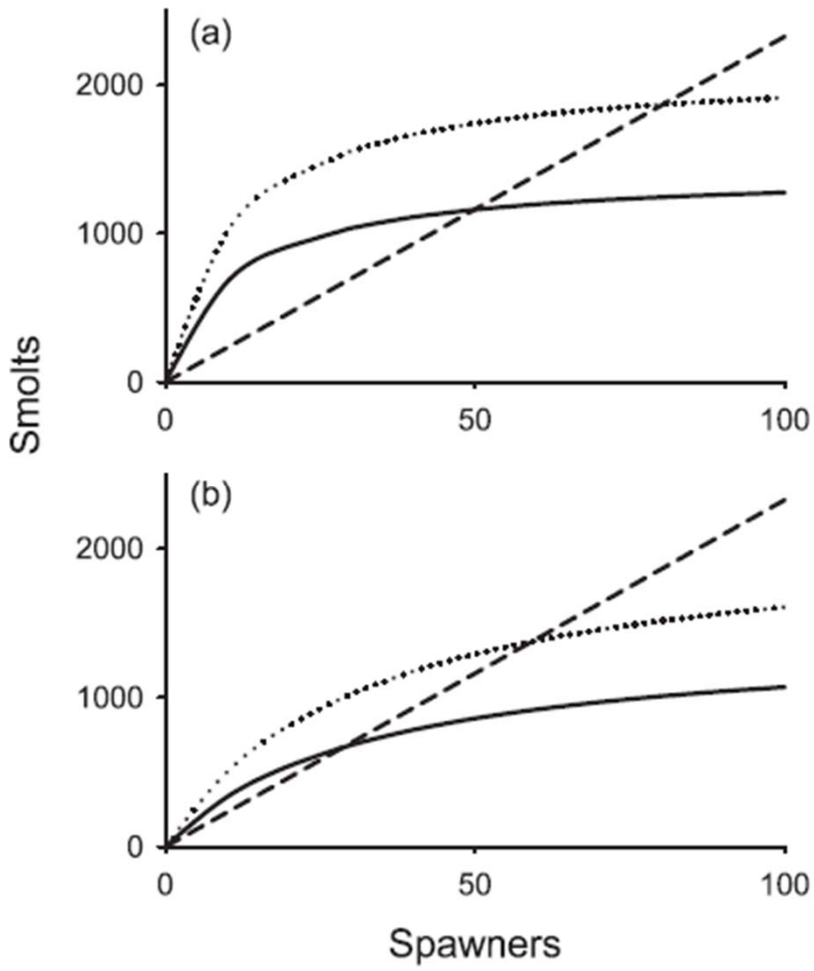
What are adult data used for (1)?

The "stock" in stock and recruitment relations:

Number of fish in the spawning reach (ideally) prorated by:

- proportion female
- age composition
- fecundity by age
- prespawning mortality
- hatchery composition

Coupled with juvenile production, the freshwater stock-recruit relation can be established where recruits here are juvenile out-migrants.



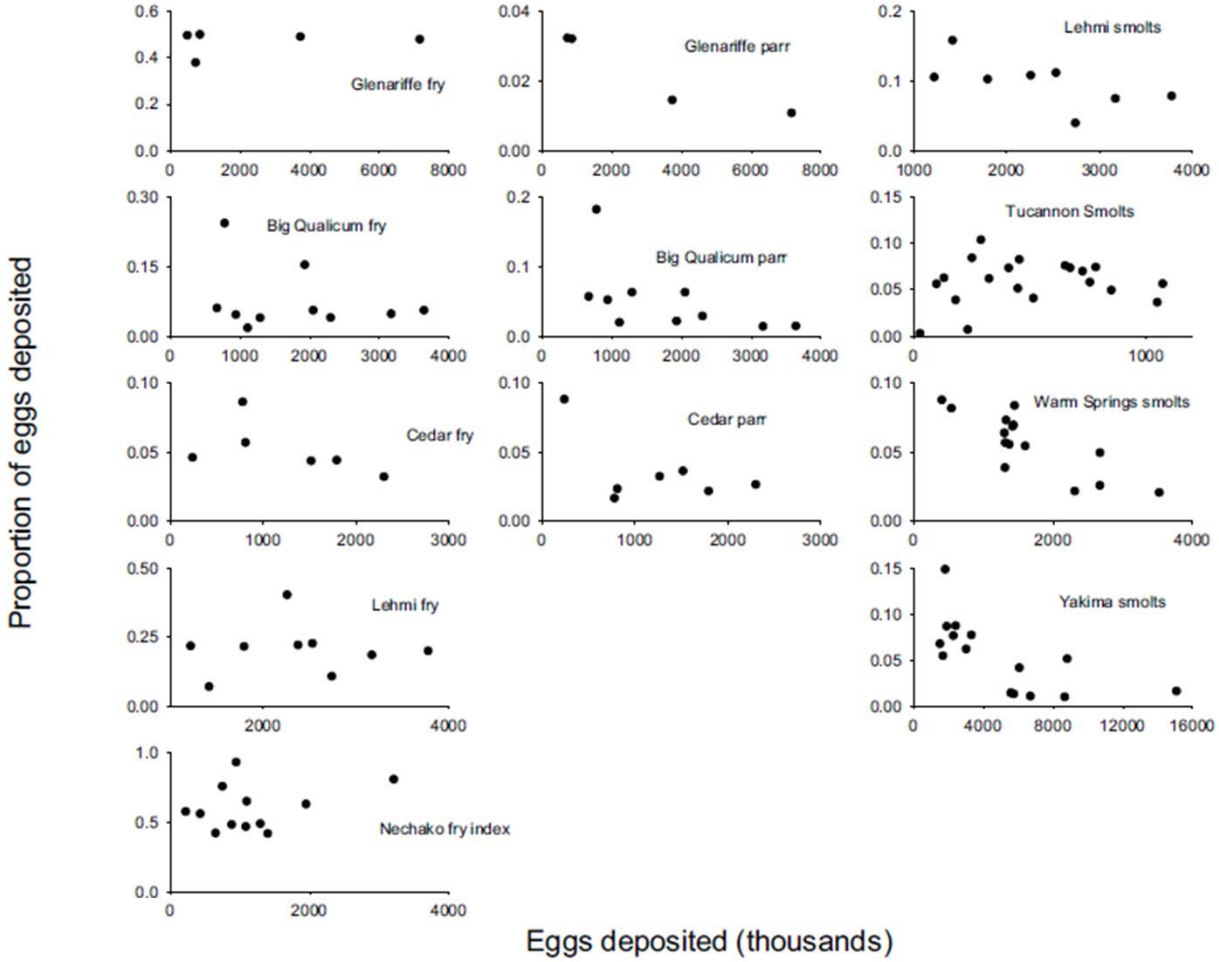


Figure 2. Compilation of freshwater life history data for eight Chinook salmon *Oncorhynchus tshawytscha* populations. In each case, the proportion of eggs deposited that result in new emerged fry, parr, or smolt migrants is plotted against the total egg deposition for that cohort. A negative slope indicates decreasing rates of production at higher densities, which maybe the result of habitat limitation. For the Nechako River, an index of fry abundance rather than absolute abundance is presented. For the Tucannon River the point near the origin was considered an outlier and was not used. Data sources are listed in Bradford (1995) with the addition of: Glenariffe, Unwin (1986); Cedar, Volkhardt et al. (2006), Nechako, NFCP (2005) and Tucannon, Gallinat and Ross (2007).

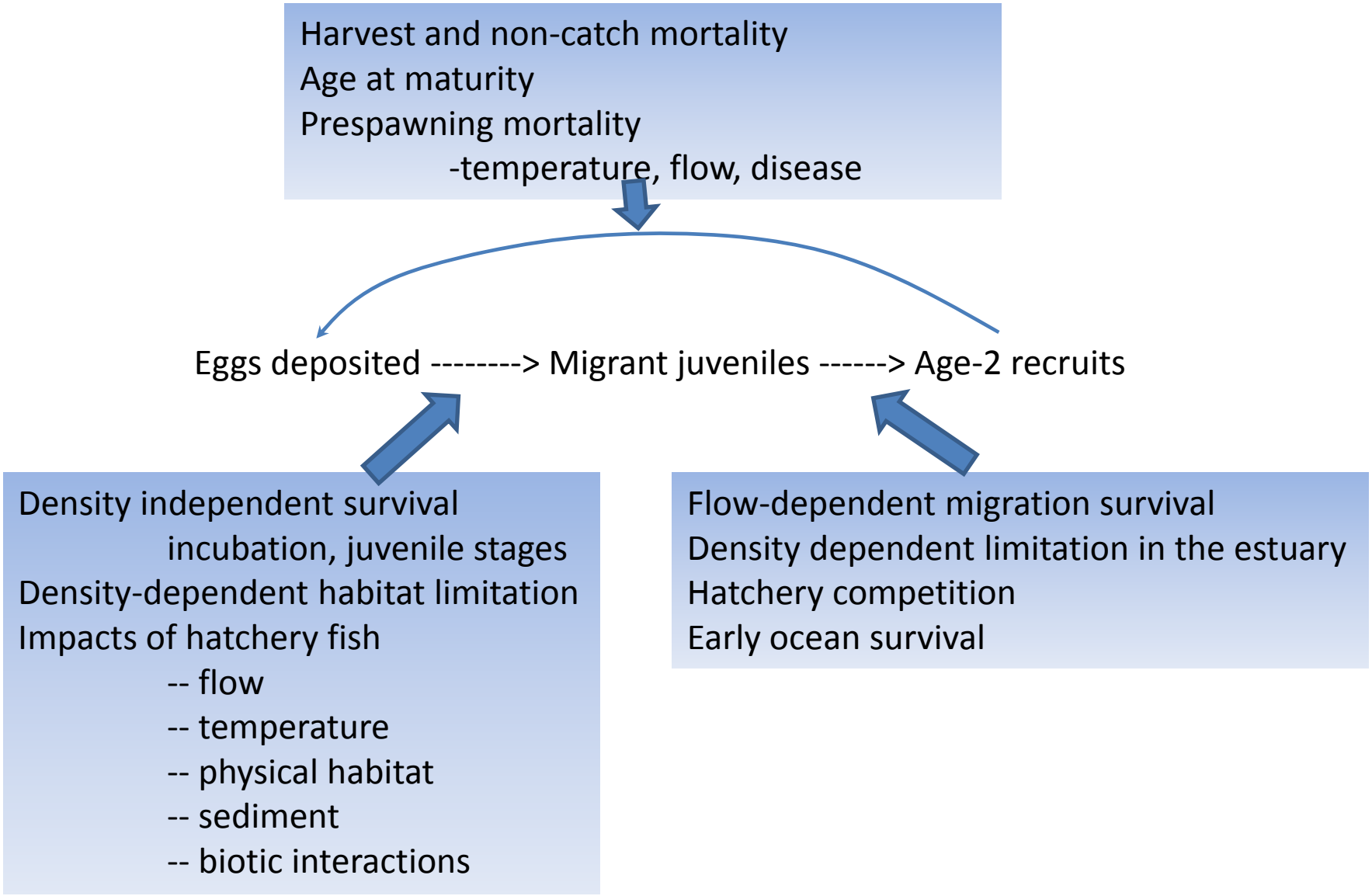
What are adult data used for (2)?

The "recruits" in stock and recruitment relations:

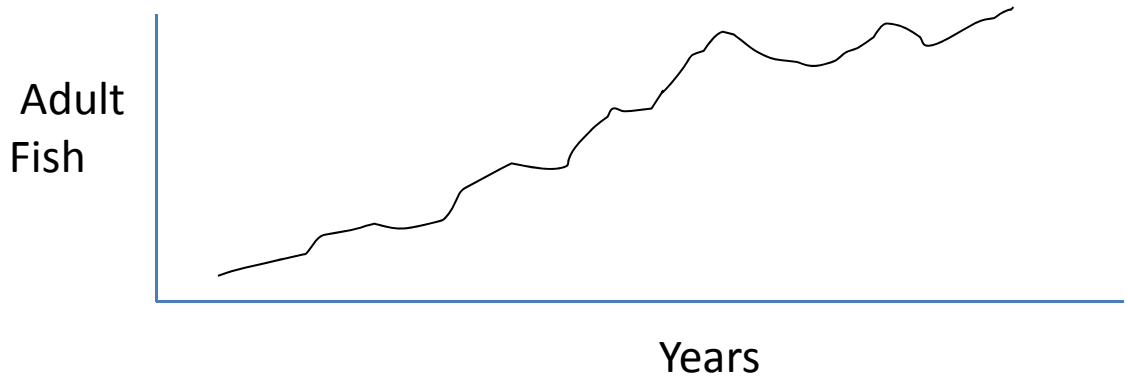
Number of fish that survive to maturity (or a surrogate such as "pre-fishery")

-Number by age/origin/(sex) in the:
    -Spawning population
    -Freshwater catches
    -Marine catches
-Expanded by estimates of mortality for each interval.

Life cycle analysis



Sorting out effects



Is this trend due to:

- TRRP management actions?
- Freshwater/estuary interactions downstream?
- Changes in ocean conditions?
- Changes in harvest?
- Unknown factors?

Review summary

- Consistent long-term field programs, high rates of sampling/effort
- Variable reporting of data, uncertainty, bias, and testing of assumptions
- Program integration urgently needed
- More analysis!

Program “themes”

1. River harvest: Klamath sport and tribal, Hoopa tribal and Trinity sport.
2. Escapement estimation: Mainstem fences, carcass M/R, hatchery returns
3. Secondary spawner characteristics: Prespawning mortality, disease, redd distribution
4. Cohort reconstruction and Brood analysis: Age sampling, cohort tables, “megatable”.

Evaluating the contribution of uncertainty

		10% CV			
	N	SD	Var	% Total Var	
	50,000	5000	25000000	95%	
	10,000	1000	1000000	4%	
	5,000	500	250000	1%	
	1,000	100	10000	0%	
Sum(n)	66,000	Sum(var)	26260000		
		SD	5124.451		

Methods to allocate fish to groups

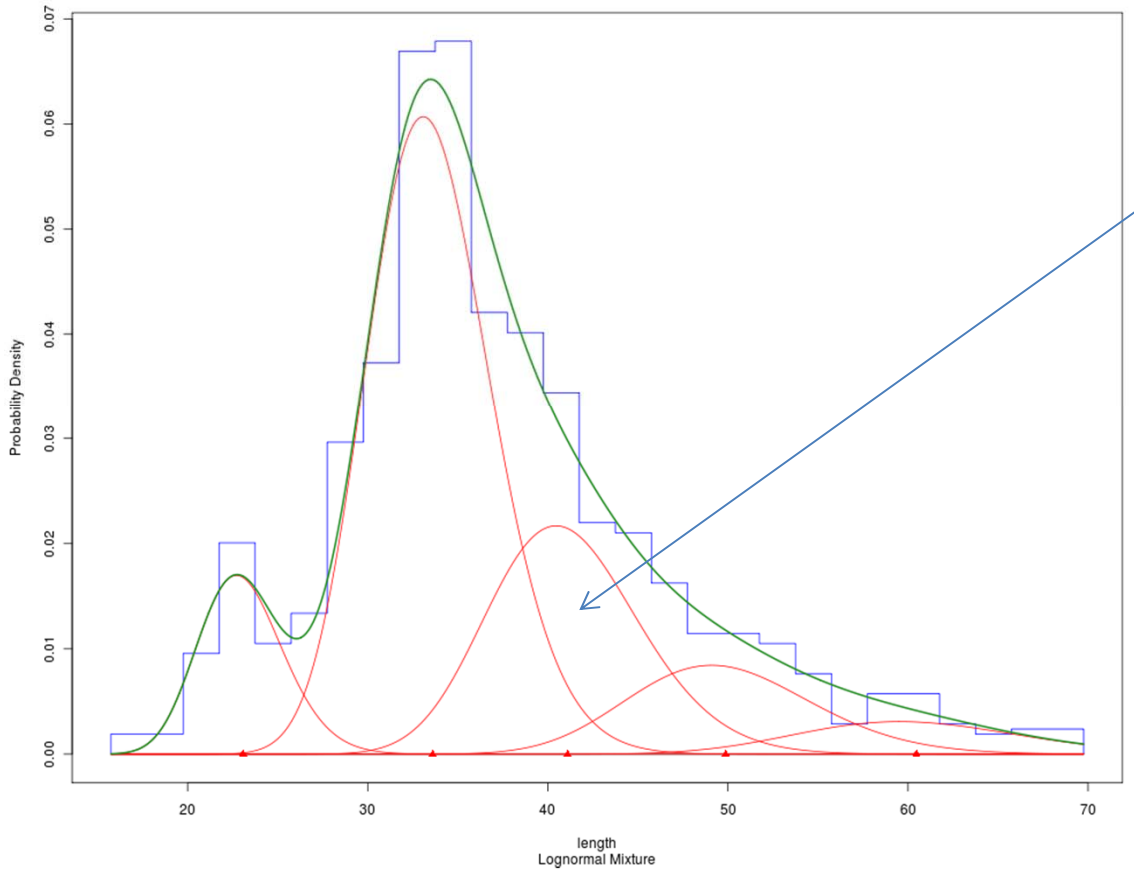
Mixdist: Macdonald and Pitcher 1987.

Estimates parameters of distributions by group.

Can use information from individuals of known membership

-Example: chinook race determined by migration timing.

use CWT or genetic subsampling to inform



Proportion in each group is found by integrating

Converting lengths to age

- Method of Kimura and Chikuni
  - Sample of aged fish used to train algorithm
  - Age composition of the aged fish is not important, as long as the distribution of lengths about is age is representative.

And speaking of age…..

- Age-3, jacks, grilse, quarter-pounders →

- Gilbert-Rich (4_2)
- European (2.1)

1. Catch monitoring

- Census-based approach
  - Effort estimated nearly every day
  - Catch rate sample matched to daily effort
  - Missing values interpolated
  - Difficult to estimate uncertainty
- Sampling approach
  - Stratify days (weekend/weekday/months etc.).
  - Sample random days for effort
  - Sample effort independently
  - Standard methods available for uncertainty estimates

Catch monitoring general recommendations

- Develop methods documents that fully describe each protocol including all formulae
- Develop variance estimators for each program
- Standardize reporting requirements:
  - Catch by age, CWT data.
  - Effort
  - Catch rates (sample sizes, variances)

Lower Klamath catch allocation

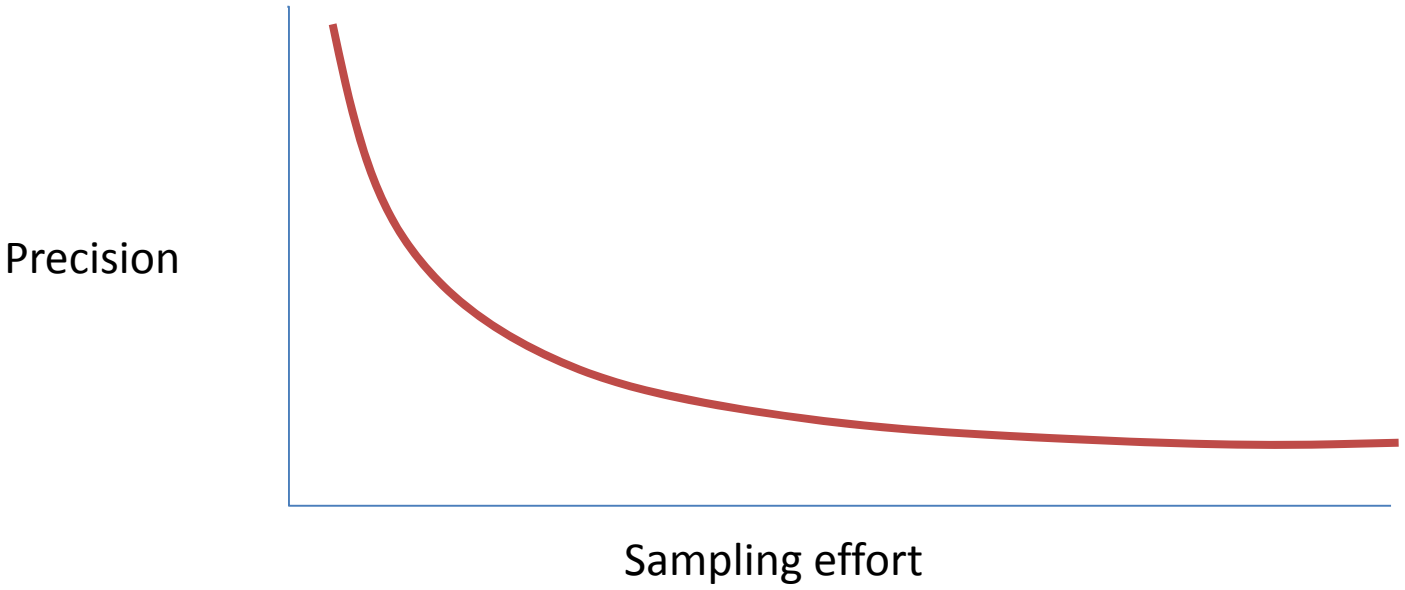
- Separating Trinity fish in the lower Klamath is a major source of uncertainty that is as large as many of the other catch components.
- CWT or other methods for historical data
- DNA for the future

Upper Trinity catch estimation

- Current methods are unclear but appear to be significant underestimates
- Propose using high-value tags to estimate non-reward tag return rate

Further analyses

- Relations between catch, effort and abundance
  - Tests of independence of the data
  - Fisher behaviour, success etc.
- Relation between sampling effort and precision



2. Trinity River escapement estimation

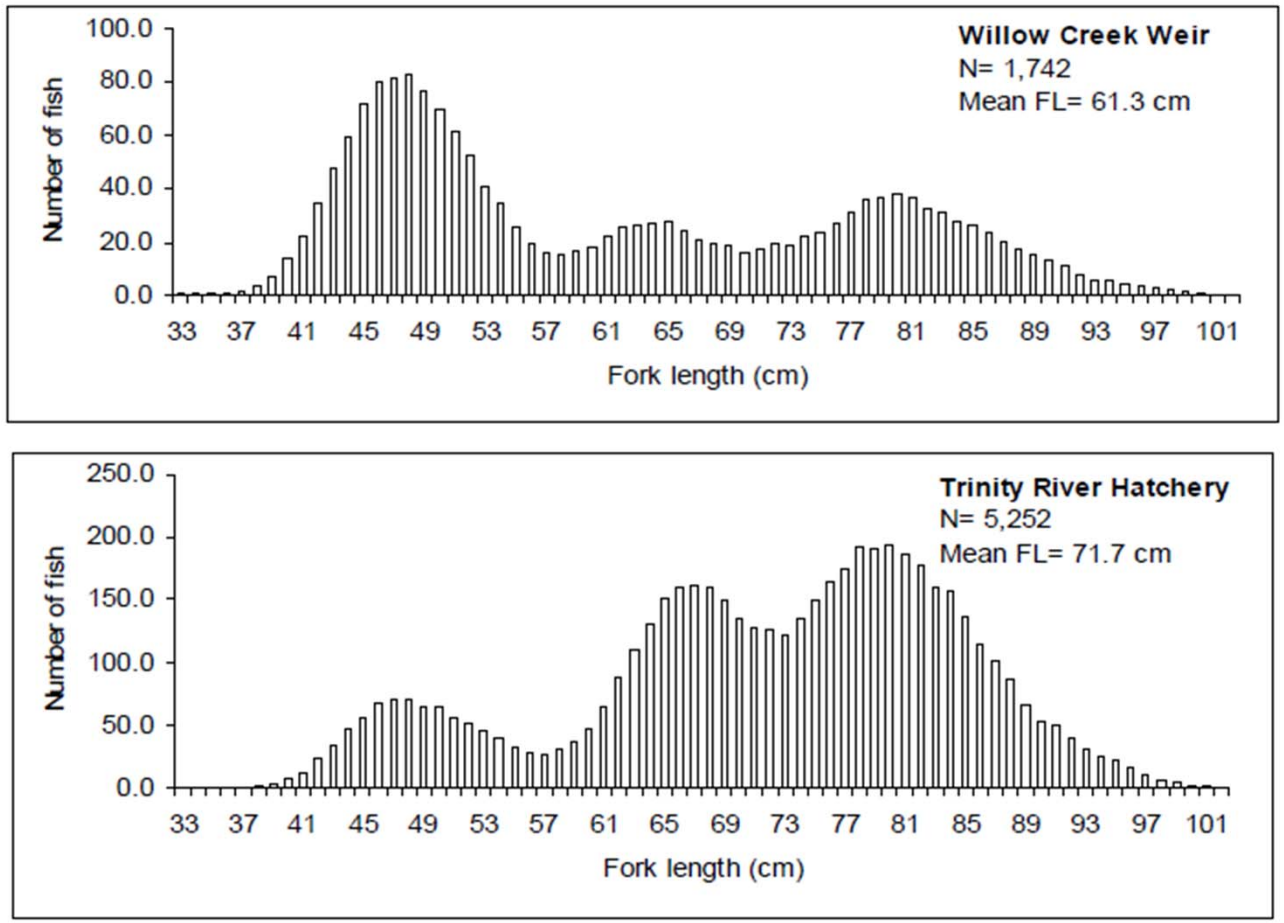
- Largest component of the run
  - Long-term program
  - Thorough reporting

- Peterson estimates are very sensitive to assumptions and usually yield overestimates.
  - Hankin 2001

Assumptions

- Because the second (hatchery) sample is biased, the first one must be representative
  - Is the weir a random sampler?
    - Large differences in the catch of age-2 fish between weir, hatchery, carcass recover in 2010.
    - In 2010 about 4% of fall chinook were tagged yet the fence is closed ~50% of the time

Differences in length structure 2008



Tag loss

- Double tagging experiments are routine in BC and Alaska
- Secondary mark, clip or punch
- Spaghetti tag losses of 30% have been observed in Alaska

Differential behaviour/mortality of tagged fish

- Very difficult to evaluate
- Temporal stratification used to evaluate age/length/date or environmental effects

Population estimates from carcasses

- Rationale for this is unclear from the IAP
- Testing assumptions is critical
- Use JCS estimator?

Spawner assessment: recommendation

- Establish a protocol for evaluating assumptions for the Peterson estimator
  - Examples from elsewhere

- Tributary spawning?

3. Secondary spawner characteristics

- Prespawning mortality estimates are important.
  - In BC 3 categories of egg retention are used: 0, 50, 100%
- Fecundity data? Available from the hatchery?
- Sex ratio?
- Project tag recoveries

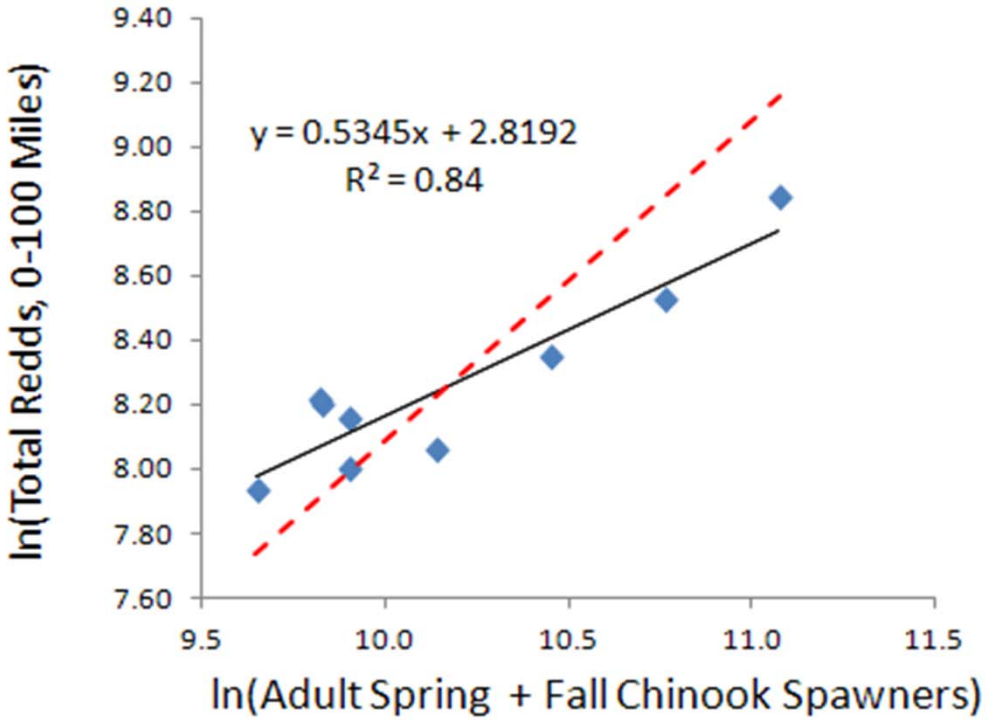
Carcass surveys

- Can objective 3.3 be satisfied with carcass data?
  - Distribution of hatchery and wild carcasses

Redd surveys

- Innovative use of new technologies
- Likely best to evaluate changes in spawning habitats
- Redd superimposition will remain a challenge for quantitative analysis

Redds and spawners



Redd and carcass surveys

- TRRP needs to define the performance measures for spawning habitat and hatchery/wild spawner interactions
- What information will inform those performance measures?

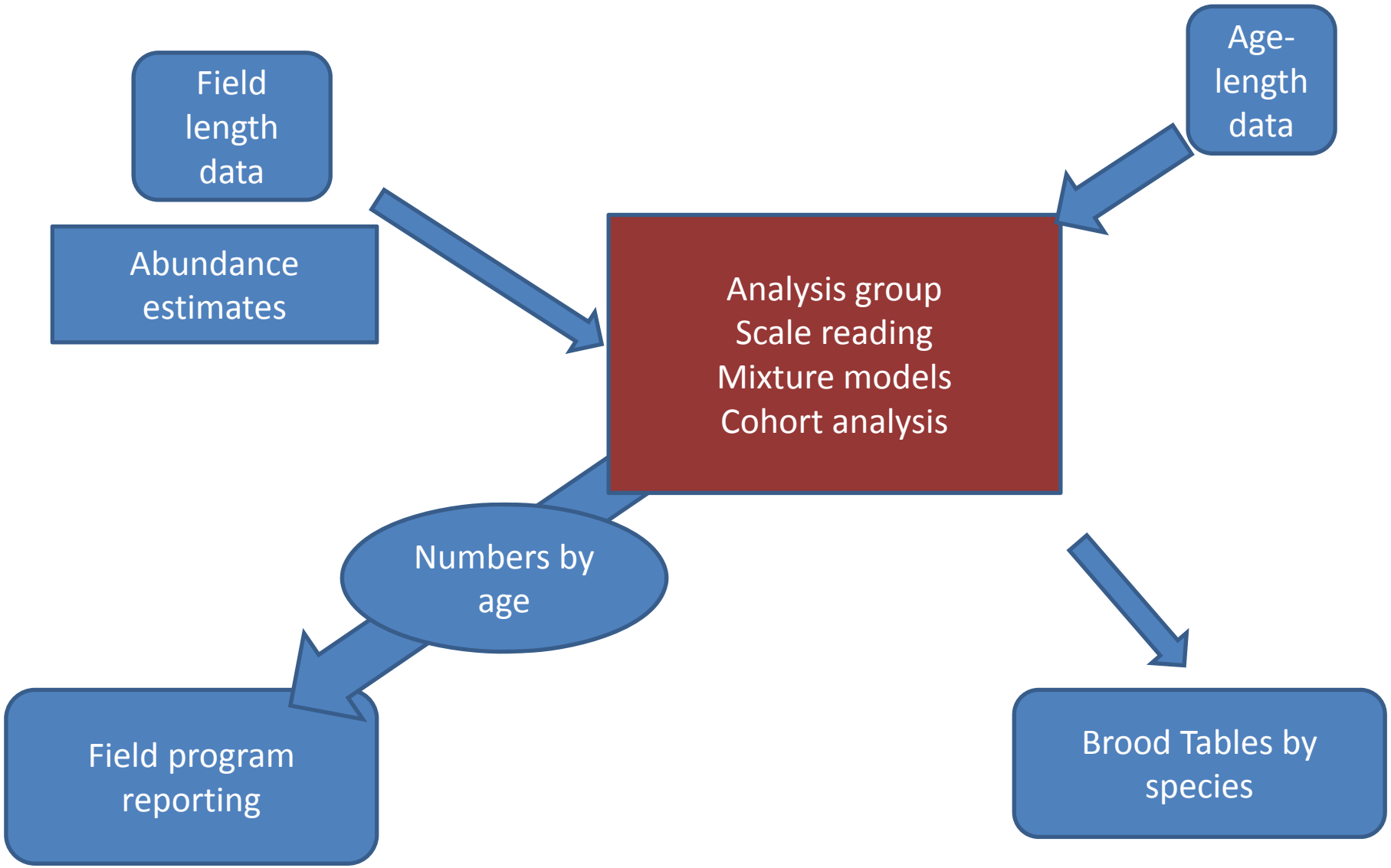
4. Cohort reconstruction and brood analysis

- This is the organizing framework for most field programs.
- Elevate to program status with sufficient resources to develop an analytical framework, incorporate 10+ years of historical data, and make recommendations for future programs.

Age, Race sampling

- Lots of ages read, validated by CWTs
- Sometimes ad-hoc procedures used
- Standardized approach for early/fall chinook separation
  - Does the chinook race matter for TRRP evaluation of habitat actions?

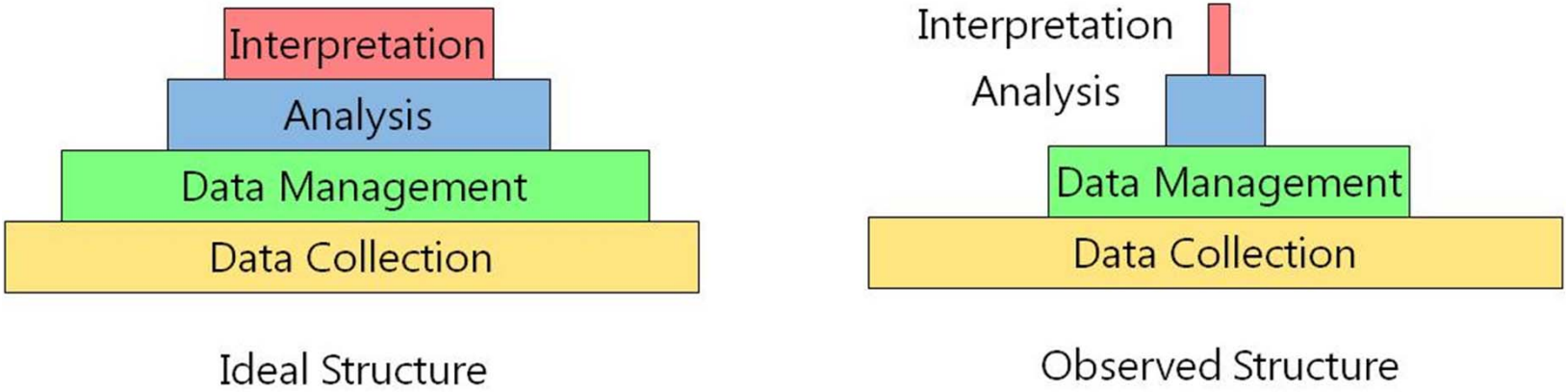
Organizing age-based data



Other activities for the analyst group

- Sensitivity analysis for sampling intensity, assumptions, parameters etc.
- The use of other “control” populations– Klamath, or elsewhere (ocean survival indicators etc.)
- More detailed demographic analyses

Adaptive management is very demanding at all levels



Idealized and commonly observed allocation of resources in adaptive management programs illustrating the under-recognition of the need for extensive analysis and reporting requirements.