PATH Workshop 4 Report
Kah-Nee-Ta Resort, April 22-24 1997
May 13, 1997

This report summarizes the main points of discussion at the PATH workshop at Kah-Nee-Ta Resort, April 22-24 1997. The objectives and agenda for this workshop are attached as Appendix A. Since the main purpose of this workshop was to report on progress and establish a workplan for the rest of FY97, we have organized the workshop notes as an annotated FY97 Task List (May 13 version). For each numbered task on the Task List, we identify issues and points of discussion that were raised at the workshop that are relevant to that task. In some cases, we refer *in italics* to manuscripts that were distributed at the workshop. A complete list of manuscripts distributed at the workshop, along with their authors, is attached as Appendix B; please contact the authors directly if you would like a copy.

A. Spring/Summer chinook retrospective analysis

General/Background

A1 Publish selected FY96 chapters in peer-reviewed literature

A2 Complete documentation of S-R data
Effect of Missing Age Composition of John Day Spring Chinook Returns (Rick Deriso)

Issues/Discussion:

- effects of age structure on S-R data were discussed at an evening session at the workshop. Results of those discussions will be incorporated into the final S-R Documentation submitted for peer review.

A2.1 Update to Ch. 2

Hydrosystem/Climate Retrospective Analyses

A3 Evaluating the delayed or additional mortality
Evaluating the Delayed or Additional Mortality (Jim Anderson)

Differences between Anderson's Stock-Recruit model and MLE model:

	Year effect	Passage mortality	Post-BON mortality
MLE	δ	m	
Anderson	α	CRiSP/FLUSH	α

Issues/Discussion:

- Results suggest alternative hypotheses:

  H_1: PNI $\approx 1/\alpha$ Env. affects upstream stocks but not downstream stocks - less sensitive to terrestrial conditions

  (But stocks from wide geographic region have same response to large-scale oceanographic effects (e.g. Beamish & Bouillon - Canada, US, Asia stocks all affected by ocean))

  H_2: % transportation $\approx 1/\alpha$

- Suggestion: Include δ in Anderson model separately (partition α)
- discuss similarities/differences between two stock-recruitment models in memo (A3.1)

A3.1 GLM models in context of retrospective analyses; compare Anderson's S-R model to MLE model

A4 Use of MLE analysis by Deriso et al. to refine interim targets for passage survival
Integration of Ch. 6 Interim Goals with Chapter 5 Approach (Chris Toole)

Issues/Discussion:
- should use Raymond SAR data in MLE model - adds only 1 parameter (non-passage mortality)
- not all original assumptions available (e.g. age structure) from Raymond paper; no one has been able to replicate methods (age-structure component)
- Raymond data for aggregate stock; index populations in BSM

A5 Effects of ocean and river environments on survival of Snake R. stream-type chinook
- draft of this available for review (Hinrichsen et al.)

A6 Estimate

A7 Alternative hypotheses for non-hydrosystem causes of upstream-downstream and spatial-temporal differences in R/S
- defines alternative hypotheses for post-BON survival for decision analysis (see task E1.3.2.3)
- draft of this in progress (Williams)

A8 Climate indicators of salmon survival
- draft of this available for review (Anderson)

A9 CWT analyses of ocean distributions of spring/summer chinook
Update on Ocean Distribution of Coded Wire Tagged Spring/Summer Chinook (Charlie Paulsen,Tim Fisher)

Issues/Discussion:
- # of observations in model # of actual observations because using expanded recoveries; very few actual recoveries
- data points not independent - observing same cohort multiple times
- some up and down river stocks have same hatchery origin (e.g. Carson)
- bootstrapping a potential alternative method

A10 Harvest Retrospective Analyses
- revised harvest chapter being submitted for peer review

Habitat Retrospective Analyses

A11 Chapter 10 revisions

Summary of Habitat Retrospective Analyses:

Question:

To what extent can changes to habitat quality or quantity explain declines in Columbia River chinook salmon?

Approach:
- Review historical changes in land-use and habitat condition
- Summarize evidence that changes in habitat lead to changes in population parameters (Ricker a, b)
- Examine more recent data for spatial patterns of habitat vs. demographics

Challenges:
- time series of run reconstructions vs. period of habitat change
- lack of time-series data on habitat changes
- “habitat is a complex topic”

Issues/Discussion:
- not much evidence in literature of habitat-population linkage
- adding more stocks with weaker data - just decreasing power of ability to detect habitat effects?
- data quality varies stock-to-stock some good quality, others lacking age-structure data
- How to weight limited # of index stocks to entire sub-basin re: habitat effects & actions
- include habitat *protection* (and further degradation) as well as habitat restoration
- should consider effects beyond FSR since these effects determine Richer a&b estimates, therefore should look at alternative S-R models (i.e. ones that include passage model mortality estimates).

A12 Ch. 4 analysis

Chapter 4 Update: Effects of Climate and Land Use on Index Stock Recruitment (Charlie Paulsen, Richard Hinrichsen, Tim Fisher)

Maps to accompany Ch. 4 Update (Tim Fisher)

Issues/Discussion:
- need to re-run with updated mid-Columbia stock-recruitment data
- concern that MLE-type model explains so much variation in Recruitment that other variables have little hope of explaining residual variation
- Alternative: look at residuals from model without land-use included vs. land-use data

A13 EA Analysis - abstract of results for broad-scale analysis of EA data vs. salmon distributions (incorporate into Ch. 10 revisions)

General Approach:
- used numerous habitat variables (e.g. geological, hydrological, vegetation, management) to classify sub-watersheds and compare to expert assessment of habitat quality

Issues/Discussion:
- unable to define habitat actions precisely; have both spatial and temporal component
- can’t eliminate extractive activities; just a matter of where in the basin and how
- Lower River Habitat - estuary conditions, pollution in lower river

A14 Finalize run reconstructions for additional index stocks

A14.1 MLE Analysis on additional index stocks

Issues/Discussion:

- potential problem with confounding of Ricker a and b:
  - positive relationship between length of spawning habitat and 1/b for Salmon R. stocks - could use this to constrain estimation of b parameter in MLE or interpret as providing some confidence that b is not confounded by a
  - Rick Deriso will use his modified Ricker parameterization that eliminates parameter correlation problems

A15 PIT-tag analysis

PIT-tag Overwintering Recovery Proportions: Preliminary Results (Charlie Paulsen, Tim Fisher, Richard Hinrichsen)

Issues/Discussion:

- time of marking
- Suggestions:
  - use EA data "cluster" variable as habitat parameter in model
  - separate summer parr tagging and fall "pre-smolt" tagging
  - look at model with year, habitat, but no "water" variables

A16 Analysis of parr density data; merge with EA data

Issues/Discussion:

- fish marked mostly in August
- analysis can be done for different periods
- PIT Tag vs. parr density: need to account for # of Spawners?
- MANTECH Report (Chris T.)

Hatchery Retrospective Analyses

Approach:

- case studies - low priority (not pursued)
- spatial comparisons - few data, confounding with differences in genetic source (not pursued)
- looked at effect of hatcheries (i.e. number of hatchery releases, release stage, release method, fraction of naturally spawning fish from hatchery) on performance of naturally-spawning stocks (time series R-S data)
- considered location of release (e.g. only included releases upstream of index stock, in index stream or an upstream tributary, etc. to include proximity of hatchery fish and wild populations)
- GLM - ln (R/S) = f (..., hatchery variables, etc.)
- residual from MLE = f(...)

Results:

- hatchery variables have no detectable effect on ln(R/S) or Residuals

Problems:

- collinearity: hatchery variables vs. m, hatchery variables with each other (single stock regressions showed collinearity, significant effects of hatchery variables)
- m + hatchery variables correlated (therefore confounded; 2 alternative hypotheses) but some stocks have no hatchery influence

Issues/Discussion:

- look at releases of other species (esp. steelhead - many more releases than s/s chinook)

- effects of over 200 million hatchery releases in entire basin on mainstem and estuary (e.g. effects on carrying capacity, disease)
- disease transmission - historical disease assays (C. Schreck analysis)
- alternative approach - build hatchery variables into MLE

Prospective Application: can tell if removal of hatchery influence will lead to improvement (or degradation) of stocks

Specific tasks:

A17 Re-do stock-level regression analysis using model that estimates mu

A18 Examine total hatchery releases vs. MLE delta (both chinook only and all spring releases)

A19 Examine regional hatchery releases vs MLE mu

A20 Investigate disease transmission (Schreck et al. analysis)

B. Fall Chinook Retrospective Analysis

B1 Run reconstructions (six stocks) and documentation (Hanford Reach, Snake R., Lewis R. only)

Data Collected for 3 stocks:
- Hanford Reach - redds 1950-96, age structure 1983-96, hatchery strays 1983-96, cwt 1975-96, wild cwt 1986-96
- Snake River stock - dam counts 1965-96, age structure 1984-96, hatchery strays 1975-96, cwt 1975-96
- Lewis River - spawners 1964-96, age structure 1964-96, cwt 1980-96

Incomplete:
- Deschutes river - redd counts 1977-96, age structure 1975-80, looking at fishery lengths and scales, some CWT

Next Steps:
- stocks - freshwater phase - verify data and identify missing components
- Deschutes River - complete and verify
- CWT cohort analysis - time series of ocean impacts
- Combine freshwater and Ocean phases for complete run reconstruction
- Ch. 3-type analysis - estimate of productivity and survival

Other Analyses:
- passage model/MLE analysis to estimate
- compare SAR’s to stock-recruit models (Chris Toole’s approach - task A4)

Issues/Discussion:
- Hanford Reach - agreement since 1986 and 1987 to control flows for redds - need to consider in S-R data (similar issue for Snake)
- In general, issues to look at in time series analysis may be different for fall vs. spring/summer

B2 Meet with PSC to work out cohort analysis

B3 Harvest analysis

B4 Ch. 3 graphical analysis

B5 Ch.6 style analysis (Snake R.)
Snake River Fall Chinook Salmon: Scoping Information Regarding Downstream Passage (Al Giorgi) - Circulated after the Kah-Nee-Ta workshop

Analytical Tools:
1. NMFS synthesize all survival estimates and examine important predictor variables 95, 96
2. NMFS resolve historical, contemporary FGE estimates

Ch. 6 tasks:
- NMFS synthesize all survival estimates and examine important predictor variables
- NMFS resolve FGE historical, current
- PIT tag data worth examining for FTT - Survival analysis

Issues/Discussion:
- possible data on predator consumption in JDD reservoir
- weak flow-survival relationships (Rich Z.)
- PIT-tag data (some problems) - NBS - Mainstem - JDD
- PATH should recommend info needs to allow future fall chinook analysis comparable to spring/summer
- define SAR standard for "robust" stocks(Hanford Reach, Lewis R.) - use these as survival standards
  - Hanford Reach - "Upriver bright report" (WDFW report should contain information on SAR)
  - Lewis R. - natural CWT groups
- may also want to compute SAR's for hatchery populations

B6 Habitat analyses - examine trends in Snake R. thermal regime to relate to run reconstructions
- Habitat group will identify retrospective habitat analyses at next meeting in late July

C. Steelhead retrospective analyses

C1 Assemble spawner escapement and smolt age data and assess potential for run reconstructions
Steelhead Data Reconnaissance and Run Reconstruction (Charlie Petrosky)

Issues/Discussion:
- crucial to distinguish A vs. B run steelhead for reconstructions; big differences in timing, size, etc.
- Lacking age data for some stocks (have age structure at BON from 1984 on)
- age of smoltification may be hard to include in reconstructions- can we predict it from length the previous fall? (may have to look at sensitivity to alternative assumptions)

C2 Investigate potential for estimating SAR

Issues/Discussion:
- need to examine SAR data available for non-Snake steelhead
- need to agree on definitions of lower/mid/upper Columbia designations for steel-

head
- may be possible to use hatchery SAR's for steelhead to look at time-trends

D. Spring/summer chinook prospective analyses

D1 Prospective analysis of spring chinook (development of BSM)
Prospective Analysis of Spring Chinook of the Snake River Basin (Rick Deriso)

Issues/Discussion:
- "passage " vs. "differential" mortality
- S-R plots for historical scenario and compare to recent period plots
- Measurement error assumption of 24% CV
  - underestimate?
  - sensitivity to this assumption?

D2 Depensatory mortality - consideration in prospective analyses
Estimating Viability Under Uncertainty (Lou Botsford)

Issues/Discussion:
- Threshold for Depensation - where is it?
- Few data at low end
- Use predation rates

D3 Description of GLM-type models in context of prospective model; compare with BSM

E. Spring/summer chinook decision analysis

Tasks for PATH Decision Analysis of Spring/Summer Chinook (ESSA) - preliminary draft distributed at workshop; revised version distributed for internal review May 2

General issues relating to decision analysis:
- how to integrate across 3 species? - do independently, then compare rankings for the three species to identify trade-offs
- considering all H actions to be independent for now
- when different H actions combined, need to consider synergistic/antagonistic effects of different actions

Role of ISAB in Decision Analysis (discussed at joint Planning Group/ISAB meeting prior to workshop)
- "Return to the River" report is prescriptive: contains hypotheses which may imply actions and measures
- need to identify key hypotheses and implied actions and performance measures in RtR and incorporate into decision analysis either quantitatively or qualitatively
- need further meetings with ISAB

E1 Hydro Decision Analysis
Alternative Structures for a Hydro Action Decision Tree (ESSA) - preliminary draft distributed at workshop; revised version for internal review in progress

E1.1 Identify alternative actions
Issues/Discussion:
- Management actions involving transportation:

A2: maximize transportation without new collection facilities or improvements
A2': maximize transportation with new collection facilities or improvements (deferred)

- No proposed action to improve survival of transported fish.
- Does PATH analyze actions other than those proposed by the IT or consult IT first?
- need to consider cost constraints on action sets (PATH or some other group?)

E1.1.1 Determine required survival improvement (see task D1)

E1.1.2 Identify alternative management actions

E1.1.3 Comments on Draft Hydro reg documentation

E1.1.4 Hydro reg scenarios

E1.2 Develop passage models

Issues/Discussion:

- may be other models proposed for use in decision analysis (e.g. what if direct service industry comes up with their own model?) -- How should probabilities be assigned - all equal? Should be some filtering of hypotheses
- All comes down to how do changes in probability assigned to models affect *rank order of decisions*
- other decision frameworks (i.e. Ch. 6 decision flowchart) complement decision analysis -e.g. Ch. 6 information relevant to assigning probabilities, identifying uncertainties

E1.2.1 Identify standard data sets

The purpose of this task is to reduce the uncertainties associated with using different data sets for calibrating various components of the passage models.

Flows and WTT:

- same WTT used by CRiSP and FLUSH (same reservoir elevations and flows)
- seasonal flow effects fish earlier in season use less flow then fish later in season
- seasonal flow effects affect CRiSP - FLUSH comparison

FTT:

- FLUSH revising FTT data and relationships to incorporate recent years PIT-tag data
- Won't get same FTT estimates from both models (at least not a close as WTT), but at least using same data sets
- Modelled FTT:WTT depends on date of release
- Different time scales (CRiSP - daily; FLUSH - seasonal)
- possible use for individual-based models?

E1.2.1.1 Historical FGEs

Fish Guidance Efficiency (FGE) Estimates for Snake and Lower Columbia River Dams in 1997 (NMFS, contact Lynne Krasnow)

E1.2.1.2 Transportation

E1.2.1.3 Dam passage

E1.2.1.4 Predation - rates, effectiveness of removal program

E1.2.1.5 Identify alternative hypotheses and models of transportation mortality

E1.2.1.6 Complete "Data set" document

E1.2.2 Incorporate standard data sets into passage models

E1.2.3 Identify reach survival data for model comparison

Reach survival data:
1966-1969 - pre-Snake R. Dams - may be most relevant to evaluating predictive ability
1970-1980 - FLUSH uses to calibrate Surv. vs. FTT relationship (except 1971 and 1972)
1982-1986
1993-1996

PIT-tag data
1989-1992 - not survival data; what fraction of fish PIT-tagged at LGR showed up at MCN

Issues/Discussion:

- survival studies over longer reaches and encompassing more projects provide a stronger test of models than studies that encompass fewer projects - how to weight particular data points used in the comparison?
- Habitat change in passage corridor post 1970
- Risk of inferring lower river survival from Snake River survival studies
- Divide old NMFS estimates into separate reaches -
  Snake River*vs. Current
  Lower River Day Snake
  total River
- data evaluation group should weight alternative data sets before comparison is done to avoid bias

E1.2.4 Compare updated CRiSP and FLUSH to reach survival data

The purpose of this task is to provide a qualitative comparison of how well best-fit models fit selected set of reach survival data. Originally, the comparison was presented as an option for assigning relative probabilities to alternative hypotheses about reservoir survival (see task E1.4.0 below). However, the hydro sub-group concluded that this test is not adequate to assign relative probabilities because of the following issues:

Issues/Discussion:

- # parameters should be considered in fits to data
- also compare survivals over different reaches (downstream of data)
- using reach survival estimates from Snake River - how to extrapolate to lower river reaches (higher predation in Snake)

- FLUSH calibration to reach survival data - can calibrate with reach survival data, then back-validate to predation data from Ward et al.

	Calibration	Validation
FLUSH	reach survival →	predation?
CRiSP	predation gas →	reach survival

- need to use a truly independent data set for comparison (i.e. one not used either explicitly or implicitly for model calibration)
  - 66-69 survival data not used by either model, but data has been around for a long time therefore not a true “out of sample” data set
  - 1997 data is “out of sample”
- reach survival data may not be the right data to fit to - what’s important is how do hypotheses affect the decision: models may fit or not fit one data set and not affect decision

Criteria for comparison of models: (Randall Peterman)

Purpose of Models:
- Forecast which management actions best for increase in R/S
- “All models are wrong, but some are useful” - G.E.P. Box

Possible criteria:
- Obs. vs. predicted
- Likelihood, corrected for # parameters

Strongest Test:
- How well reflect past conditions most similar to new “managed” system, e.g. 1966-69 (no Snake River Dams)
- Set models “at risk” in new situations to compare performances.
- Major changes to the modelled system provides a qualitative test of model behavior, therefore should expose models to new situations

Weaker Test:
- Compare how well models reflect past data in certain life stage
- different models may match different time periods of data but have same SSQ
- A better approach to comparing the models may be to identify the most useful components of each model, then combine into a 3rd model

E1.2.5 Finalize mechanism for linking passage models to BSM

E1.3 Identify Uncertainties

E1.3.1 Identify key uncertainties

Reservoir survival
- predation largest source of mortality
- agreement on Raymond data
- PIT-tag data - Skalski already done analysis (weighting release groups by abundance)
- should check sensitivity of mortality estimates to starting dates
- in touch with Ward-predation studies and effectiveness of predator removal program

- may be some systematic difference in habitat conditions - improvement in John Day habitat over last 20 years.

Dam Passage survival
- agreement on components of dam passage mortality

Transportation survival
- agreement on barge mortality
- alternative hypotheses about the magnitude/mechanisms of post-BON mortality of transported fish:
  - H1: assumes some post-BON mortality due to passage through hydro system
  - H2: Some other systematic difference between upstream and downstream stocks; post-BON mortality is due to something other than passage through hydro system

E1.3.2 Representation of uncertainties in reservoir, post-BON survival

E1.3.2.1 Representation of uncertainty in reservoir survival

- look at uncertainties in:
  - level of predators
  - consumption
  - change in predation → change in survival

E1.3.2.2 For hydro-related hypotheses about post-BON mortality, use passage models/alternative transportation models

Alternative models of transportation survival (including post-BON survival):

H_1: S_T = F(WTT) - alternative transportation models used in Ch. 5 based on TCRs of 1.6:1 in 1986, 3.0:1 in 1977

H_2: S_T = F (arrival time relative to spring transition)

H_3: S_T = Constant

H_4: constant TCR

H_5: T:C $=1/S_N$, Direct (Raymond)

H_6: Mundy =f(WTT)

E1.3.2.3 Synthesize evidence for/against non-hydro-related hypotheses about post-BON mortality (see task A7)

- draft of this in progress (Williams)

E1.3.3 Representation of drawdown uncertainties

Major Uncertainties:
- velocities
- what will be the differences between post-drawdown and pre-dam river conditions?
- what fraction of survival rate in 1960's will survival return to after drawdown
- predator response in drawndown system
  - change in predators after drawdown
  - change in prey for smolts (minor)
  - change in predation activity
  - change in spill → predator concentration
  - change in temperature

- timing of decision, litigation, appropriation, implementation
- show what survival improvement is foregone by delaying one year
- how to predict effects of drawdown:
  - use passage or other models vs. use pre-dam reach survival data?

E1.3.3.1 Synthesize data sets, case studies

Data Sets:

- survival from pre-impoundment period
  - R/S
  - SAR (some)
- data from dam removal
  - fisheries effects data (where available)
- WTT, WTT:FTT relationships, PIT-tag recoveries in unimpounded reaches (both upper and lower river)
- water velocities barrier (small openings in dams lead to increase in water velocities - barrier to retuning adults
- mid-Columbia through Hanford Reach PR → MCN
- IH: Raymond data (1 mile matches PIT-tag data)
- project mortality
- Use fluid dynamics approaches and pre-dam cross-sections to estimate FTT under drawdown
  - Idaho Department of Water Resources
  - Corps contract with Batelle to build 3D hydro-dynamic model of:
  - velocities
  - turbidities
  - predator habitat
- USGS/NBS scoping of predator effects in John Day

Case studies:

- Snake River (3) - Lewiston, Harperston, Sunbeam
- others - Corps looking for engineering data from other dams

E1.3.3.2 Review data, decompose problem, establish range of values

- meeting scheduled for May 21

E1.4 Estimate probabilities

E1.4.0 Identify and describe options for estimating uncertainties

Approach A: Use Stock-recruit data to derive probabilities
Approach B: Use other data sets or assign equal probabilities
Approach C: Expert judgment

Issues/Discussion:

- discomfort with upstream - downstream differences built into MLE; there may be other options that do not rely on upstream - downstream comparisons

Options for quantifying uncertainty in reservoir mortality using Approach B:

1: Assess alternative forms of FLUSH and alternative forms of CRiSP independently

- Branches of decision tree for “Reservoir Survival” node:
  FLUSH -Different data sets for Survival vs FTT

CRiSP - Different values of Predation intensity P(E)
Issues: Doesn't allow direct comparison of hypotheses across models

2: Compare observed reservoir survival to predicted reservoir survival for CRiSP and FLUSH
Issues: no independent reservoir survival estimates

3: Compare observed reach survival to predicted reach survival for CRiSP and FLUSH
Issues: See issues under task 1.2.4 above

4: Compare alternative functional forms of reservoir survival vs. FTT or WTT (including explicit FLUSH relationship and implied CRiSP relationship)
Issues: Different spatial and temporal scales (e.g. FLUSH - seasonal average, CRiSP daily)
FTT may not be the primary determinant of reservoir survival in CRiSP

5: Monte Carlo approach - randomly sample from distribution of all parameter values in the models, then fit resulting predicted reach survival to observed reach survivals and calculate likelihood for that particular combination of parameter values. Sample many times to obtain posterior distribution of values for all parameters, then sample from these posteriors in BSM and integrate to get expected values of performance measures.
Equations:

$$P(M1|D) = P(D|M1) / \Sigma P(D|Mi)$$
$$P(D|M1) = \int P(D|M1, \theta 1)P(\theta 1)d\theta$$
$$\approx 1/N \; \Sigma P(D|M1, \theta i)$$

Issues: will have same problem as Option 3 - still need to look at fit of model to data from that historical period that most closely resembles future conditions

Approach C: Expert Judgment (Robin Gregory)
Another option for assigning probabilities is to go through a formal expert elicitation process. Robin Gregory, an expert in these techniques, gave a short primer on expert elicitation at the workshop (the following is an extract from a memo by him)

The primary uses of decision analysis in eliciting expert judgments are to decompose the uncertain subject matter, to quantify judgmental probability distributions for the decompositions, and to re-aggregate the elicited probability distributions using probability theory. A comprehensive expert judgment should include the following steps:

1. Formulation of the technical question that is to be answered
2. Selection of the experts
3. Training of the experts regarding process and judgmental biases
4. Decomposition of the technical question
5. Elicitation of probability distributions
6. Recomposition of and aggregation across expert opinions
7. Documentation

Issues/Discussion:
- delaying decision in order to do expert elicitation could have negative consequence

  - timing could be responsive (iterative process)
- should be parallel value elicitation process on value side
- elicitation done individually - presented to group individually or aggregated, depending on comfort level
- how to separate uncertainty and variability in probability estimates?
  - can ask separately, if experts are aware of difference
  - can decompose the problem to identify - important step
  - ask experts to provide information on uncertainty/variability
- how to combine distributions from different experts?
  - can be done - techniques/experts available
- how to structure and prioritize questions to get elicitation on
  - do expert elicitation on that issue - "what information would be most valuable to get?"
- don't want to do expert elicitation on everything
  - for subgroups to decide what are the most essential things to ask
  - can do a more informal elicitation for the less critical questions

E1.4.1 Run new versions of passage models

E1.4.2 Assign probabilities to passage model output

E1.5 Calculate Performance Measures

E1.5.1 Decide on performance measures and criteria

E1.5.2 Calculate performance measures

E1.6 Apply Criteria

E1.7 Sensitivity Analysis

E1.8 Decision Analysis Report

E2 Habitat Decision Analysis

Discussion about Habitat Actions (also applies to Hatchery and Harvest):

- Hydro decision to be made in 1999
- Habitat improvements important in evaluating hydro actions
- No one is specifically tasked with making a habitat decision: who should recommend habitat actions - PATH or somebody else?

```
habitat actions →|    habitat  →survival     →performance measures
                        |   changes   improvements
                        |
                        |
disagreement    |    agreement on this
over this       |
```

Prospective question posed by Habitat group:

- how much of an improvement to life-cycle survival of Columbia River chinook salmon could result from improvements to habitat quality or quantity?

Approaches:

Option A: Population-level analysis - use results of retrospective analysis to define possible changes in Ricker a, b vs. habitat change

- compare delta mu's required to meet survival/recovery goals from prospective analyses (task D1) with the difference between the highest and lowest Ricker 'a' value for the index stocks (range of 'a' values represents the maximum improvement in survival available from habitat improvement, assuming good habitat = high a values, poor habitat = low a values)
- compare EA data to Ricker parameters

Option B: Stock-by-stock assessment of habitat improvements possible → changes in survival at specific life stages → population-level effects

E2B.2 Review sub-basin planning exercise, etc.

- Mike Jones has reach-level database for Smolt Density Model; includes estimates (judgments) of smolt capacity, reach length and area, and habitat quality

E3 Hatchery Decision Analysis

- no comments on specific tasks

E4 Harvest Decision Analysis

Issues/Discussion:

- not PATH's job to identify harvest actions
- Tom Cooney (liaison with IT, fish managers) have fish managers check existing harvest schedule and identify range of possibilities for future schedules (from conservative to permissive)
- PATH subgroups(Olaf) - review fish manager's recommendation

Appendix A. Objectives and Agenda

Objectives:

1. Review and discuss progress on FY97 tasks (feedback and cross-fertilization among work-groups)
2. Review/revise objectives for FY97 and beyond
3. Determine priorities and advance methods for remaining tasks
4. Develop work plan for rest of FY97

Agenda:

Tuesday, April 22 - Workshop Day 1

Background, introductions, workshop objectives and agenda (D. Marmorek)
Current work plan (as set out in Wenatchee, with revisions)
Review long-term plan (1997-1999)

Progress reports on spring/summer chinook prospective tasks:
- Prospective model - structure, delta mu results (R. Deriso)
- Effects of assumptions about stock response at low abundances on prospective analyses (L. Botsford)
- Discussion
- Decision analysis task list (D. Marmorek)
  - Tasks that are completed/underway - progress report
  - Tasks not yet started - intended approach/assumptions/data
- Discussion - general comments; key links to Return to the River

Ongoing work on passage models and data sets (E. Weber, J. Anderson, Paul Wilson, Al Giorgi)

Progress reports on retrospective tasks in work plan; potential use in prospective analysis:

Spring/Summer chinook retrospective

- C. Toole - Integration of Ch.6 interim goals with Ch. 5 approach
- E. Weber - further analysis of drawdown
- J. Anderson/R. Hinrichsen
  - Correlation between Ch. 5 delta and PNI
  - “Effects of the Ocean and River Environments on Survival of Snake River stream-type Chinook Salmon”
- C. Paulsen - Results of PIT-tag analyses
  - Update to Ch.4, incorporating land-use data, environmental variables
  - CWT analyses of ocean distribution

Age-structure discussion

Wednesday, April 23 - Workshop Day 2

Progress reports on retrospective tasks in work plan; potential use in prospective analysis (cont.):
- M. Jones - progress on habitat analyses
- P. Wilson - progress on hatchery analyses

Fall chinook retrospective:

H. Schaller - progress on run reconstructions for fall chinook
A. Giorgi - Ch. 6-style analysis for fall chinook

Steelhead retrospective
C. Petrosky - progress on data reconnaissance, run reconstructions for steelhead

Expert elicitation in decision analysis - methods and examples (Robin Gregory)

Sub-group discussions
Group A: Hydro/Harvest; Group B: Habitat/Hatchery/Steelhead/Fall chinook
Review tasks, determine priority given revised objectives for fiscal year
Review progress on analyses required for prospective/decision analyses; discuss methods; determine priorities for future work
Brainstorm additional tasks necessary for prospective/decision analyses, who is responsible, schedule for delivery

Subgroups:

Subgroup A	Subgroup B
Jim Anderson, UW/CBR Tom Cooney, WDFW Jim Geiselman, BPA A. Giorgi, Don Chapman Consultants *David Marmorek, ESSA* Randall Peterman, SFU Calvin Peters, ESSA Jim Peterson, NBS Chris Pinney, Corps of Engineers Steve Smith, NMFS Chris Toole, NMFS Earl Weber, CRITFC John Williams, NMFS	Larry Barnthouse, McLaren Hart Ray Beamesderfer, ODFW Lou Botsford, UC Davis *Mike Jones, ESSA* Lynne Krasnow, NMFS Olaf Langness, WDFW Danny Lee, USFS Charlie Paulsen, PER Charlie Petrosky, IDFG
Rick Deriso, IATTC Howard Schaller, ODFW Paul Wilson, CBFWA	

Thursday, April 24 - Workshop Day 3

Sub-group discussions continue (including discussion of research/monitoring needs)
Sub-groups report/Discussion
Work plan for rest of FY97; general plan for FY98
Spring/summer chinook prospective (FY97)
Fall chinook retrospective (FY97) and prospective (FY98)
Steelhead retrospective (FY97) and prospective (FY98)
Review products for SRP review

Appendix B. Documents distributed at Kah-Nee-Ta Workshop

1. Agenda (ESSA)
2. Alternative Structures for a Hydro Action Decision Tree (ESSA)
3. Chapter 4 Update: Effects of Climate and Land Use on Index Stock Recruitment (Charlie Paulsen, Richard Hinrichsen, Tim Fisher)
4. Effect of Missing Age Composition of John Day Spring Chinook Returns (Rick Deriso)
5. Estimating Viability Under Uncertainty (Lou Botsford)
6. Evaluating the Delayed or Additional Mortality (Jim Anderson)
7. Fish Guidance Efficiency (FGE) Estimates for Snake and Lower Columbia River Dams in 1997 (NMFS, contact Lynne Krasnow)
8. Integration of Ch. 6 Interim Goals with Chapter 5 Approach (Chris Toole)
9. Maps to accompany Ch. 4 Update (Tim Fisher)
10. PATH Workplan developed in Wenatchee (ESSA)
11. PIT-tag Overwintering Recovery Proportions: Preliminary Results (Charlie Paulsen, Tim Fisher, Richard Hinrichsen)
12. Prospective Analysis of Spring Chinook of the Snake River Basin (Rick Deriso)
13. Steelhead Data Reconnaissance and Run Reconstruction (Charlie Petrosky)
14. Tasks for PATH Decision Analysis of Spring/Summer Chinook (ESSA)
15. Update on Ocean Distribution of Coded Wire Tagged Spring/Summer Chinook (Charlie Paulsen,Tim Fisher)