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Logic Chain Status Report by John Cain, American Rivers

Note: The PREs have some disagreements with some of the statements below, which are illuminated with comments in brackets. These issues are identified here to let the reviewers know discussion is ongoing, but their resolution is not believed necessary for purposes of logic chain review.

Overall Process and Development

In late November, the BDCP steering committee directed John Cain to work with scientists and BDCP technical experts to develop a “strawman” of the upper portions of the logic chain for review and refinement by a broader group of agency, PRE, and NGO scientists potentially under the auspices of the CALFED Science Program. The logic chain is defined and described further in attachments A and B. The upper portion of the logic chain addresses goals, objectives, hypotheses, and thresholds of desired change.

Summary Progress Report

John Cain convened meetings with a small group of scientists to develop draft products that would facilitate review and development of the upper portion of the logic chain by a larger group of scientists. This effort has completed drafts for longfin smelt, winter and spring-run salmon, and has initiated drafts for Delta smelt, fall-run and green sturgeon (See attachment C – excel spread sheet).

Obtaining broader scientific input is the next step in the process. BDCP members have met with the Cliff Dahm of the CALFED Science Program to discuss how the science program could assist with convening a workshop to review and develop the upper portions of the logic chain. Most of the work at the workshop could be conducted by agency, NGO, and PRE scientists, but assistance from a few outside or independent scientists contracted by the science program could

Goal(s) and Objectives

Goals are ultimate outcomes regarding recovery of the ecosystem/covered species; these are statements that describe what is needed to achieve the recovery. [PRE COMMENT: NCP/NCCP goals and objectives are NOT the same as recovery plan objectives. They are intended to be consistent with recovery plan goals but not required to be the same nor to be sufficient to achieve recovery.] Objectives should be “S.M.A.R.T” – that is, specific, measurable, achievable, relevant (to the goal), and time-bound. [PRE COMMENT: “SMART” is not a term of art in conservation plans. While the concepts may be applicable, there is no requirements that conservations be written to meet the “SMART” definition.] Neither Goals nor Objectives should specify how we get to the goal nor adopt a particular hypothesis about what prevents us from getting there. [PRE COMMENT: We disagree, hypotheses are often included implicitly or explicitly in conservation plan goals and conservation measures.]

Goals and objectives are not permit terms and therefore are not intended to legally bind the permittee. They are, however, essential elements for guiding plan development and

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measuring plan performance. The overall plan goals and objectives may be larger than the permittees' obligation, but the permit terms should require some level of measurable progress toward the overall goals.

To date we have assumed that the permittees' responsibility will be to "contribute to recovery," which is presumably defined by the recovery plans for various covered species. [PRE COMMENT: PREs believe that contribution to recovery is any benefit that is provided above and beyond what is required to mitigate for take associated with covered activities proposed by the applicant.] Therefore, it is logical to assume that the BDCP goals and objectives should be consistent with recovery plan goals to enable measurement of the BDCP's contribution to recovery.

Goals

Figure 3.3 of chapter 3 prominently references recovery plan goals, but the actual text of chapter 3 does not actually identify recovery plan goals making it difficult to assess how the BDCP goals described in chapter 3 would contribute to the overall recovery plan goals. This is understandable since the draft salmonid recovery plan was only recently released and the resident delta fish species recovery plan is undergoing revisions.

Chapter 3 goals cover three categories, but the logic chain effort is currently addressing only species specific goals and objectives. Chapter 3 recommends utilizing the "attributes of population viability" approach to structure species specific goals and objectives, but the actual species goals statements only partially address the four attributes of viability: abundance, distribution, diversity, and population stability.

The logic chain effort to date has not yet attempted to revise BDCP *goal* statements for consistency with the attributes of viability and the existing recovery plan documents, but one option would be to simply have the following goal for all covered species.

- **Species Specific Goal:** Increase the abundance, distribution, diversity (genetic and life history), and population stability of covered species.

Objectives

The logic chain effort has preliminarily identified options for one or more objectives for each attribute of viability for each species in attachment C.

Policy guidance will be necessary to select SMART objectives to guide the BDCP effort. [PRE COMMENT: As stated above, BDCP objectives are not required to comply with the "SMART" definition.] The logic chain effort reviewed recovery plan goals and interviewed experts to identify recovery plan goals and objectives to refine the chapter 3 objectives, where necessary, into SMART objectives for covered species. Chapter 3 objectives are often neither SMART nor related to the attributes of viability. In many cases, some interpretation is necessary to distill recovery plan objectives into a useful format for BDCP.

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Scientists can help identify additional options for measurable objectives in a technical workshop, but policy makers will need to make choices regarding the level of detail and scope that is appropriate for the BDCP. For example, scientists have identified the following options for a long fin smelt abundance objectives, but policy makers will need to decide which objective is more appropriate to guide the BDCP. [PRE COMMENT: The PREs disagree with this paragraph and the examples given below. It is likely impossible to measure population level changes of certain species at all, let alone the incremental benefit towards population recovery contributed by a given measure or the BDCP as a whole. We do agree there need to be indicators of system response and performance of the various conservation measures, but disagree with the ability and the legal necessity for attempting to so at the species population level.]

- Grand Mean: ≥ 1 fish/tow (CPUE) Grand Mean of Fall Midwater over 4 months (first ten to twenty years of the index didn't usually go below this -- Kimmerer unpublished)

Or

- "Longfin smelt will be considered restored when its population dynamics and distribution pattern within the estuary are similar to those that existed in the 1967-1984 period." (see pp.56-66, 1996 USFWS Recovery Plan)

Hypotheses

The stressors or limiting factor that potentially prevent attainment of the objective are listed in attachment C and summarized in tables 1-3 for longfin smelt, winter-run, and spring-run salmon. Due to scientific uncertainty, these are merely hypotheses that should be tested through implementation of the plan. Active adaptive management requires acknowledging uncertainty, identifying competing hypotheses, and explicitly designing the restoration plan to test these competing hypotheses as part of the restoration process.

Chapter 3 attempts to state hypotheses in the problem statement associated with each goal. A more detailed and systematic description of the hypotheses, however, is necessary to construct an adaptive management that will actually test hypotheses. The following excerpt from chapter 3 illustrates an overly broad hypotheses that is impossible to test.

- **Goal GE CF1:** Increase the abundance of covered fish species by reducing sources of unnatural mortality.
- **Problem Statement:** Non-natural sources of mortality are a substantial factor inhibiting the abundance and distribution of covered species and the diversity and growth of their populations. Reducing the proportion of covered fish species populations that are subject to loss from these sources of mortality will support increasing the abundance, distribution, diversity, and growth of covered fish species populations.

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To avoid overly broad hypotheses statements, the logic chain proposes identifying hypotheses under each SMART objective, rather than lumping general hypotheses under broad goal statements as is currently done in chapter 3.

Scientific input from a future workshop could greatly help articulate hypotheses more clearly and thereby increase the prospects for a successful adaptive management plan. Scientists can help articulate hypotheses in a manner that better illuminates the underlying problems. For example, two ways of describing the predator hypotheses:

- **Predation—Abundance:** Abundance and diversity of predators increases predation pressure on migrating wr juveniles
- **Predation -- Competitive Advantage:** Competitive advantage of predators in the Delta environment leads to unnaturally high levels of mortality of migrating juveniles/smolt.

Attachment C does not attempt to rank the importance of the various hypotheses. This is an essential step that will require considerable scientific input and very likely entail some level of controversy. Furthermore, due to scientific uncertainty today, it is probable that the ranking of hypotheses will change as the program is implemented. A flexible, trustworthy governance mechanism will be key to evaluating and adjusting the mix of leading hypothesis over time.

Measurable Thresholds of Desired Change

For the “desired change” category, attachment C identifies the boundaries between a minimal detectable level of change (detectable in terms of population response) and that change which would alleviate the stressor entirely. Both of these levels are often difficult to define but even a rough "order of magnitude" is useful for the purposes of determining which levels of change would be measurable. Scientific input would be particularly helpful for determining minimum and maximum levels of detectable change.

For each hypothesis, the desired change is the particular condition that would be necessary to both advance the objective and, equally important, test whether the hypothesized stressor actually limits the population of a particular covered species. Small changes may be theoretically beneficial to covered species, but if they are not large enough to test the underlying hypotheses, then it would be impossible to ascertain whether any benefit had actually occurred.

For example, a five or ten percent reduction in the number of predators in a particular location would not be sufficient to test the underlying hypotheses that the abundance of predators limits covered species populations because:

1. 5-10% is probably similar to the margin of error in any estimate of the number of predators, and

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2. predator populations may be limited by number of prey. Elimination of a 5-10% of total predators may simply provide the remaining predators with a better opportunity to consume prey.

Locally reducing predator populations by 30-50 percent, however, would be far more detectable.

Conservation Measures

Each conservation measure should both advance the conservation objectives and test the underlying hypotheses regarding what limits the population of covered species. If a conservation measure does not result in sufficient change to test the underlying hypotheses, then it will be impossible to ever ascertain whether the conservation measure was worthwhile. BDCP should prioritize conservation measures that test multiple hypotheses and advance multiple objectives.

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Table 1

Hypothesized Stressors (limiting factors)	Life stages – Winter-run Chinook				
	Egg/Larval	Juveniles – Upstream	Juveniles/Smolt – In Delta	Ocean	Adult Migrants
Food	N/A	X	X		N/A
Physical Substrate	X	X	X (floodplain)		---
Temperature	X	X	X		---
Predation (Diversity/Abund.)	---	---	X		---
Predation (Comp. Advtg)	---	X	X		---
Toxins	---	---	X		---
Entrainment	N/A	---	X		N/A
Flows (Transport, Attraction, Incubation, etc.)	X	---	X		X
Hatchery	X	---	---		---
Migratory Barriers	N/A	X	---		X

Table 2

Hypothesized Stressors (limiting factors)	Life stages – Spring Run				
	Egg/Larval	Juveniles – Upstream	Juveniles/Smolt – In Delta	Ocean	Adult Migrants
Food	N/A	X	X		N/A
Physical Substrate	X	X	X (floodplain)		---
Temperature	X	X	---		X
Predation (Diversity/Abund.)	---	---	X		---
Predation (Comp. Advtg)	---	X	X		---
Toxins	--	X	X		---
Entrainment	N/A	---	X		N/A
Flows (Transport, Attraction, Incubation, etc.)	X	X	X		X
Hatchery	X	---	---		X
Migratory Barriers	N/A	---	---		X
Dissolved Oxygen	---	X	X		X

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Table 3

Hypothesized Stressors (limiting factors)	Life stages – Longfin smelt			
	Egg	Larvae (endogenous feeding)	Juveniles/Sub-Adult and Ocean	Adult Spawners
Food	N/A	N/A	X	X
Physical Substrate	X	---	---	(see egg)
Temperature	X (spawning window limit)	X	X	---
Predation (compet. advtg)	---	X	X	X
Predation (diversity and abundance)	X (silverside)	X (silverside)	---	---
Toxins	X	X	---	X
Entrainment	N/A	X (by year type)	---	X (by year type)
Flows (Transport, Attraction, Incubation, etc.)	X	X	X	X
Area of Low Sal Zone habitat	N/A	X	X	---
Migratory Barriers	N/A	N/A	N/A	X
Dissolved Oxygen	---	---	---	X