CALFED/38

DEVELOPING AN APPROACH TO ESTABLISHING GOALS AND TARGETS

Introduction

Establishing a quantitative vision of ecosystem health for an ecosystem as complex and as altered as the Bay-Delta will be difficult. Historical population related targets may be difficult to achieve in a system reduced in size by dams and impacted by introduced species. Functional goals based on geological, chemical, and biological processes are limited by human intrusion and the demands for economic production, public health and safety, and recreation. Selecting a percentage of habitat acreage or ecological function available at some historical period, may have little meaning without population data to support the vision. A reference system would provide a natural model to guide our decision, but an undisturbed ecosystem with the complexity and variability of the Bay-Delta system does not exist. Existing restoration programs provide some guidance, but to date we have not found any restoration effort with the scope and complexity of ours, or degree of conflict that must be resolved.

The following describes three general approaches that may be used to develop goals and targets. These three methods include: 1) reconstruct a historical pre-disturbance perspective; 2) utilize diagnostic and prescriptive indicators for aggressive adaptive management; and 3) utilize a historical reference period incorporating existing disturbances. By discussing the strengths and weaknesses of these approaches it is anticipated that we can utilize the best features of each in developing targets and goals.

Historical Pre-disturbance Perspective

The goal should be the restoration of ecosystem "health" and the restoration of structural elements, functional organization, and species composition comparable to the historic natural habitat in diversity, resilience to stress and sustainability.

The objectives should be specific, desired, qualitatively or quantitatively defined ecological conditions characteristic of a "healthy ecosystem." These include restoration of native species biodiversity, diversity of natural habitat types, natural production of valuable species and habitats for harvest and recreation, natural hydrological patterns, natural trophic structure, natural patterns of transport of essential elements (nutrients, sediments, etc.), and water quality. A reference condition or set of reference conditions should be used to establish minimum objectives, for example, restoration of no less than 25 percent of pre-disturbance habitat acreage; biodiversity or access to habitat equivalent to a period when fish and wildlife species were abundant and widely distributed (i.e. 1920-1950).

The targets should be high-resolution, quantitative objectives. All targets should meet threshold criteria for habitat quanity and quality (i.e. areal extent or magnitude of flow, geographic distribution, minimum patch size, connectivity, diversity of habitat type, use by different species and by different life history stages of individual species, duration and timing, effects of inter- and intra-annual variability).

Targets should be achieved in three phases: 1) completion of program arrangements necessary to achieve targets; 2) specified milestones toward full achievement; and 3) attainment of desired ecological condition.

Short-term targets to: 1) recover and maintain native species biodiversity, especially viable populations of estuary-dependent native plant and animal species of concern; and 2) support natural production of valuable fish and wildlife species for sustainable recreational and commercial harvest, should be achieved in a 5-10 year period.

Long-term targets to recover and maintain: 1) natural Bay-Delta ecosystem dynamics (habitat mosaic, hydrological patterns, etc.) at the ecosystem level, within each ecological zone, and throughout each habitat type; and 2) complex biological communities favoring native species biodiversity, should be achieved in a 5-30 year period.

Diagnostic and Prescriptive Indicators

As a result of various workshops and discussions over the last year, the following restoration framework has been proposed.

Step 1. Identify the products of the ecosystem that are not adequately being produced. These might range from such mundane products as non-toxic sportfish harvest rates per angler hour and sustainable commercial harvest tonnage, to more esoteric issues such as assurance of continued existence of native fishes or satisfaction of voters generally with the Delta aquatic environment. Loosely speaking, these are the "goals" of ecosystem restoration and as addressed by many participants at the early CALFED public workshops. *In the human health analogy these correspond to a recounting of aches and pains.*

Step 2. For each of the products identified in Step 1, develop a measurable, scientific parameter that corresponds to the goals of Step 1, but which cannot be directly manipulated. Thus, one would not use "catch rates of striped bass" because that could be achieved by restricting the number of fishing licenses. An appropriate metric might be something like "natural production of 3 year-old striped bass." These parameters will reflect the natural processes that lead to the desired products and should be derived through the knowledge and professional opinions of biologists and engineers. These refined goals are the "diagnostic goals." *These are diagnostic for the ecosystem like a medical doctor might translate a patient's sore knee into a measure of joint strength and mobility.*

Step 3. Develop relationship equations for each of the "diagnostic goals" and parameters that are affected by human action. This will necessitate the use of life-cycle models and multi-parameter analyses to identify likely controlling factors. The biologically important parameters that affect biological resources, and can be manipulated by humans, comprise the list of possible CALFED "actions." This is the stage at which "science" comes into the planning process.

In many cases this step will require the construction of intermediate steps (perhaps production of young-of-year fish, survival to 1 year, survival to 2, survival to 3), and the regression lines will not be significant due to the restricted amount of data available. In some cases, biological opinions will be the only basis for assessing a relationship. However, this analysis will produce useful guidance:

1. What are the most likely <u>controllable</u> factors?

2. Which controllable factors are most likely to result in changes in the diagnostic variable? (i.e. which factors maximize controllability and effectiveness?)

3. Which management actions are the most effective in affecting the diagnostic goal? (i.e. what is the bang for the buck?)

4. Which studies or adaptive management strategies are possible to improve our understanding of the relationship? (i.e. what is the feasibility on smaller scales).

Also, at this stage, it will be necessary to examine the extent to which actions associated with one goal are contradictory to the needs of another goal. Optimizing complementary actions to achieve all ecological goals is a functional and focused form of "ecosystem management." For example, striped bass hatcheries may have a high effectiveness in producing striped bass but possibly a negative effectiveness in restoring other species. Restoration of high habitat diversity is probably less apt to produce conflicting results for the various goals. *In human health these correspond to the identification of treatment options - palpating the joints, reviewing the patient's recent activities and genetic predispositions, and consulting outside specialists. Steps 3 and 4 might correspond to experimental treatment and exploratory surgery.*

Step 4. Set the level of CALFED actions consistent with achievement of a first phase of restoring the function measured by the diagnostic indicator; this level of action is the "prescriptive goal." By setting different levels in different areas, or by addressing one type of action in one part of the estuary and a different level in another, CALFED can begin a series of adaptive management efforts that will result in the maximum effectiveness of later restoration actions by addressing a diversity of efforts in early stages. *Concluding the human analogy, as soon also possible the patient needs to receive treatments that can reasonably be expected to cure his aches and pains, although it may be most effective in the long run to use one treatment on the knee and something else on the other in order to provide the information needed for the best long term solution. Identifying the best long-term treatment will be done by reference to the diagnostic measures of joint strength and mobility.*

The use of "diagnostic" and "prescriptive" clarifies what we are trying to achieve. All participants might agree that ecosystem products should be aimed at some historical level. Confusion stems from thinking that the prescriptive actions should also be related to historical conditions.

Despite what some participants have said, it is irrelevant whether a particular functional relationship between a goal and an action was compromised recently or not. Particularly in regard to habitat efforts we lack any usable quantification of the relationship of habitat diversity and fish abundance, survival or distribution. However, the slope of the relationship may be steeper and apply to more ecosystem products than any other single action. Thus, to get the same level of ecosystem response as we would get from $1 billion of habitat restoration might require $5 billion of water project impacts or $10 billion to construct hatcheries for all species of interest. Thus, bang for buck is a more appropriate criterion for CALFED priorities than focussing only on recent impacts.

The report from the IEP estuarine ecology team will provide a necessary first step toward setting these goals and actions.

Historical Reference Period

A qualitative vision may be a way to achieve our needs. There have been points in time when professionals and the lay public considered the health and productivity of the ecosystem to be in balance with the unavoidable demands of society and there is some precedent for this approach.

The U.S. E.P.A. selected the late 1960's through early 1970's as a time when the X2 or mixing zone of the Delta was in a near optimal location. The North American Waterfowl Habitat Management Plan used the acreage of wetlands and the amount of waste grain necessary to support the average wintering waterfowl population present from 1970-79 to establish its goals. Anadromous fisheries proponents used the average populations from 1967-91 to set the "doubling goal" for the Central Valley Project Improvement Act. The Department of Fish and Game has used, "recent historical levels" to set its goal for striped bass population levels. In each of these examples, and there may be others, there apparently was an understanding, or the perception, that some important component of the ecosystem was healthy.

Some hybrid of quantitative targets and qualitative goals may be best for the CALFED Bay-Delta Program. We can select a reference period when no species was known to be threatened of extinction, when chinook salmon and striped bass supported both quality sport fisheries and a stable commercial harvest, and when migratory and resident wildlife were abundant. The reference period could serve to set population targets and many of our habitat goals.

For our qualitative goals we need to look both at reference periods and at limiting factors or stressors. Unscreened diversions have limited the productivity of our fisheries since the 1800's. The level of pollution in the 1960's was unacceptably high, even though fish and wildlife populations were relatively healthy. Some limiting factors or stressors must be addressed independent of their presence or absence during the selected reference period. Some problems, such as those associated with some exotic species cannot be resolved. In these cases we will have to compensate for their impacts of providing some conditions which are more productive than the reference period.