CALFED Bay-Delta Program Fish Assessment Process
Species and Assessment Variable Selection
September 6, 1996

Introduction

The CALFED Bay-Delta Program (CALFED) is developing an assessment process for various resource categories, including fish, to be used in the programmatic assessment of three preliminary CALFED alternatives. As part of this effort, CALFED is also developing a comprehensive program of ecosystem restoration that will improve ecosystem function and the recovery of Bay-Delta species. This program of ecosystem restoration actions will be common to all alternatives. Only the water conveyance and storage components will vary between alternatives and could have different effects on ecosystem function and the associated fish species. Assessing the potential impacts and benefits of implementing each alternative will assist in the selection and implementation of a preferred alternative.

CALFED has met with key agency representatives and other fish experts to share information and receive suggestions on the fish resource assessment process. Based on input from participants in the CALFED process, the following information includes a revised species list, criteria used to develop the species list, and a discussion of important or key assessment variables for each species. The discussion that follows explains, in detail, the methods applied to select the species and assessment variables to be included in the impact analysis for the Programmatic Environmental Impact Report/Environmental Impact Statement (EIR/EIS). Twenty-three species were selected for inclusion in the fish impact analysis, 16 species of fish and 7 species/groups of invertebrates (Table 1).

Methods for Selecting Species

The aquatic ecosystem potentially affected by CALFED actions extends from the major reservoirs on Central Valley rivers downstream through San Francisco Bay. Over 100 species of fish occur in the affected habitats (Table 2). To simplify the selection of representative species, the aquatic ecosystem was divided into five communities. The fish communities are based on divisions described in Moyle (1976) and include:

- reservoir fishes,
- fishes in the squawfish-sucker-hardhead zone of Central Valley rivers,
- fishes in the deep-bodied-fishes zone of Central Valley rivers,
- estuarine fishes, and
- marine fishes.

The fish species that occur in each of the communities are listed in Tables 3 through 7. Many of the species occur in two or more communities. Species interactions between the communities may be significant. Species population abundance in one community may depend on conditions and species success in other communities. Interactions are especially important for anadromous species. For chinook salmon, spawning and early rearing occurs primarily in the

squawfish-sucker-hardhead zone of Central Valley rivers. Adult chinook salmon migrate through the marine, estuarine, and deep-bodied-fishes communities to reach their spawning habitat; therefore, habitat conditions in those communities affect spawning success. Likewise, juvenile chinook salmon outmigrate through the deep-bodied-, estuarine-, and marine-fishes communities, and survival is dependent on the rearing and migration conditions that occur in those communities.

The purpose of the fish assessment process is to broadly identify benefits and impacts to fish for each alternative and assist in the selection of a preferred alternative. The methods identified for each species in each community will be used to assess effects of implementing each alternative when compared to baseline (existing) conditions. Species population interactions, including interactions among different ecosystem communities, will be considered qualitatively.

Fish Species

A reasonable subset of species needs to be selected for inclusion in the impact analysis for the Programmatic EIR/EIS. The primary criteria used to develop the subset of species are:

- the species must be important,
- the species population abundance must respond to assessment variables affected by CALFED alternatives, and
- the species' response to assessment variables affected by CALFED alternatives is unique and is not reflected by the response of co-occurring species in the aquatic community.

The screening process is primarily applied to fish. However, during meetings with State and federal agency biologists, several invertebrates were identified that may be important to consider while assessing impacts. The fish and invertebrate species identified met all three of the criteria listed above.

Determining Species Importance

Species importance is the first factor considered. A species may be considered important if it meets any one of the following criteria:

- supports a commercial fishery,
- supports a sport fishery,
- is listed under the federal Endangered Species Act (ESA) or the California Endangered Species Act (CESA), or
- has a significant ecological role.

Species support commercial and sport fisheries if they are currently part of the sport or commercial catch. Species listed under ESA and CESA include species listed as threatened or endangered, species proposed for listing as threatened or endangered, and species of special concern.

"A significant ecological role" generally refers to those species that have substantial direct effects on factors affecting the abundance of other species. The effects can include the importance of the species as prey, the effects of the species as predator or competitor for a limited resource, and the effects of the species on physical or chemical habitat conditions. For example, the Asian clam has a significant ecological role because of probable effects on phytoplankton and zooplankton abundance (Herrgesell 1993). Sacramento squawfish has a significant ecological role because of predation on juvenile chinook salmon (Vogel et al. 1988).

The criteria are assigned values based on the relative importance of a species. The criteria is assigned a value of 2 if the species is very important, 1 if the species may be important or is of lesser importance, 0 if the species is not important, and blank if species importance is unknown. If the sum of the values for all criteria is greater than 1, the species is considered for inclusion in the programmatic analysis (Tables 3 through 7).

For example, chinook salmon (i.e., winter-run) and delta smelt are assigned a value of 2 for the ESA criteria because both are listed under the act (Table 6) . Longfin smelt is assigned a value of 1 for the ESA criteria because the U.S. Fish and Wildlife Service (USFWS) determined that the species does not currently warrant listing under ESA. However, longfin smelt abundance has been low and listing under ESA or CESA may be reconsidered.

Determining Species' Response to CALFED Alternatives

The second factor considered in selecting species to be included in the impact analysis is whether the species' population abundance would be potentially affected by CALFED alternatives. The CALFED alternatives could potentially affect water temperature; flow; diversion; barriers; estuarine salinity; reservoir drawdown; spawning habitat; rearing habitat; pollutant concentration (including acid mine waste, urban and municipal waste, and agricultural runoff); disease; species interactions (i.e., predation and competition); fishing (i.e., commercial, sport, and illegal); food availability; sedimentation (e.g., increased sediment input from dredging or erosion); and hatchery production. Survival is the primary measure of fish species response to potential CALFED effects, although the indirect effects of growth and migration on survival will also be considered.

The assessment variables potentially affected by the CALFED alternatives are assigned values based on the importance of the species-variable interaction and on availability of information. If the species response to a variable is critical to survival or critical to the maintenance or increase of a species' population abundance, the variable is assigned a value of 2. If the variable may be important but needs further discussion, the variable is assigned a value of 1. A variable that has minimal effects on a species is assigned a value of 0. If information on a species-variable interaction is not available and the species response to the variable is unknown,

the value is left blank. If the sum of the values for all variables is greater than 1, the species is considered for inclusion in the programmatic analysis (Tables 3 through 7).

Determining Unique Species Responses

Whether or not a species' response to the potential effects of CALFED alternatives is unique may be difficult to determine. If an assessment variable potentially limits a species' population size and is limiting only to that species, the species would be considered important to include in the impact analysis. If the response of two species is similar, the analysis of the response of one species could adequately represent the response of other species. The response of each species could be considered unique, depending on the level of detail required to address management questions. For the Phase II programmatic evaluations, a general species response to the assessment variables is sufficient for assessing potential impacts and benefits of each alternative.

An example of a unique species response might be represented by the relationship between spawning success for chinook salmon and spawning habitat. Spawning habitat must include appropriate substrates (e.g., nonarmored gravels of a specific size), water velocity, and water depth. Spawning habitat needs for other species are not representative of the needs of chinook salmon.

An example of a more general response to potential effects of the alternatives might be represented by rainbow trout, brown trout, chinook salmon, kokanee, and coho salmon that reside in reservoirs. All of the salmonid species may respond similarly to potential effects representing reservoir conditions. The response of rainbow trout may adequately represent the response of other resident salmonids in the reservoir.

If the species' response to potential effects of the alternatives may be represented by the response of another species, the representative species is identified (Table 8). Please note that chinook salmon, although identified as a single species in Tables 1 through 8, will be treated as multiple species (fall, late fall, winter, and spring runs) based on migration timing and geographic isolation.

Selection of Species Specific Assessment Variables

The response of species to the assessment variables was a factor considered in selection of species and is also considered in the selection of assessment variables to include in the fish impact analysis. A second factor in the selection of assessment variables is the potential change in the assessment variables that could be attributable to the CALFED alternatives.

Conveyance and storage components may differ between alternatives and result in variable impacts to fish resources. Assessment variables potentially affected by differences in conveyance and storage components include:

- flow,
- reservoir drawdown,
- water temperature,
- estuarine salinity,
- food availability,
- sedimentation (and erosion), and
- diversion.

The selected species potentially affected by each assessment variable are identified in Table 1 (i.e., the assessment variable is critical to changes in species abundance).

The Water Quality Program and the Ecosystem Restoration Program will be common to all CALFED alternatives. Assessment variables potentially affected by actions under the Water Quality Program include water temperature (i.e., multi-level reservoir release structures), estuarine salinity, food availability, and sedimentation (i.e., dredging regulations) (Table 1). Assessment variables potentially affected by actions under the Ecosystem Restoration Program include water temperature (i.e., riparian restoration effects), estuarine salinity (i.e., habitat reclamation), food availability, sedimentation (i.e., erosion control programs), diversion (i.e., fish screens), barriers, spawning habitat, rearing habitat, pollutants, fishing, and hatchery production (Table 1). Although actions addressing fishing and hatchery production may not be major components of the Ecosystem Restoration Program, they may affect the success of other restoration actions and will be considered in the fish impact analysis.

Two assessment variables, disease and species interactions, would not be directly affected by CALFED actions, although they could be indirectly affected. In general, information on the response of species to disease and species interactions is generally unavailable. Disease and species interactions will not be included as assessment variables for the fish impact analysis, but will discussed in a more general manner.