UPPER SACRAMENTO RIVER SALMON AND STEELHEAD ADVISORY COMMITTEE

Report No. 2

Coleman National Fish Hatchery

August 1984

COMMITTEE

Established by the Director of the California Department of Fish and Game in December 1982

Chairman Dan Frost, Redding. Attorney; former member, California Water Commission; and former member, Regional Water Quality Control Board.

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Dick Pool, Lafayette. Engineer, businessman. Director of energy with large bay area manufacturing firm. Representing United Anglers,

Charles Moss, Redding. Member, City of Redding Planning Commission; local bass club leader.

Joe Patten, Redding. Water projects engineer; former member of the California Advisory Commission on Salmon and Steelhead.

Barry Hecht, Albany. Hydrologist who generally works on habitat related problems.

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INTRODUCTION

Salmon and steelhead runs in the upper Sacramento River have experienced an alarming decline over the past three decades. In an effort to reverse this trend, the California Fish and Game Director established the Upper Sacramento River Salmon and Steelhead Advisory Committee to identify causes of these declines and make recommendations for the restoration of the fisheries.

In Report No. 1, which was submitted to the, director in July 1983, the committee focused on problems at Red Bluff Diversion Dam and -the Tehama-Colusa Fish Facility.

In this second report, the committee has evaluated what was originally described in 1942 as the Shasta Salvage Plan for maintaining chinook salmon runs blocked by Shasta Dam and has examined remaining components of the original plan, including the Coleman National Fish Hatchery (Coleman) and the Keswick Dam Fish Trap (Keswick).

The purposes of this report are to (1) objectively review all facets of the Shasta Salvage Plan; (2) identify operational, financial and political constraints that limit salmon and steelhead production at Coleman; (3) make recommendations to enhance Coleman's ability to increase production and help restore salmon and steelhead runs in the upper Sacramento River to historical levels.

By reviewing past and present Central Valley Project mitigation objectives, Coleman production capability, operational philosophies, and related problems, as well as post-project evaluation studies, the committee was able to identify critical problem areas that need prompt corrective action and/or additional development and support.

SHASTA SALVAGE PLAN

Since their construction in the early 1940s, Shasta Dam and its downstream regulatory dam, Keswick Dam, have blocked fish access to 50 percent of the salmon and steelhead spawning grounds of the Sacramento River system. Initially, the Bureau of Reclamation did not recognize the dam's threat to the fishery. A study of the impending fishery problems was authorized only after bids were received in 1938 for construction of Shasta Dam.

As part of the study, fish counts were taken at Redding which estimated the number of salmon using spawning gravels above Keswick to be only 60,000. The counts, however, were not complete, and it is now recognized that the number of salmon far exceeded that number.

Following the study a plan known by varying titles and generally referred to as the "Shasta Salvage Plan" was developed. The aim of the plan was ostensibly to compensate for the impending elimination of spawning above Keswick. The plan was refined by a Bureau-appointed

Board of Consultants in concert with the United States Fish and Wildlife Service and the California Division of Fish and Game.

The adopted plan presumed that two-thirds of the annual runs above the site of Keswick Dam could spawn naturally in the river and its tributaries below Keswick, whether the runs were left in the river or trucked to tributaries. The plan called for the remaining one-third of the estimated runs (comprising, in today's terms, parts of winter and spring runs, early portions of the fall run and latter stages of the late fall run) would be trapped at Keswick and artificially propagated at a fish hatchery on Battle Creek.

The plan suggested that most of the spring chinook would be trapped and transferred to Deer Creek for natural spawning and that most fall chinook would spawn naturally in the main stem Sacramento River. Based on those suppositions, it was concluded that it would be necessary to construct a fishway to provide access to the upstream spawning gravels of Deer Creek, a rack on Deer Creek and three racks on the main river between Battle Creek and Keswick Dam to assure proper distribution of fish for main river spawning.

Steelhead were not mentioned in any part of the plan, nor were the late fall and winter salmon runs.

In addition to the Deer Creek facilities arid river racks, the Bureau of Reclamation agreed to provide fish ladders, traps and lifts at Keswick Dam; seven fish tank trucks; the new Coleman Hatchery and appropriate appurtenances on Battle Creek upstream from an existing Bureau of Fisheries hatchery; and five racks on Battle Creek for holding and ripening transferred adult salmon.

Continuing biological studies to determine the success of the salvage operation also were recommended by the Bureau of Fisheries.

RESULTS OF THE PLAN

The plan to distribute fall-run salmon spawners in the upper Sacramento River by means of three racks or weirs failed completely. Only the Balls Ferry and Middle racks were constructed on the river, and both were washed out by the first high flows. No less a failure was the plan to transport spring-run salmon from Keswick Trap for release above a rack on lower Deer Creek. In addition to the mortality associated with loading and hauling, the released fish refused to ascend Deer Creek and succumbed to high summer water temperatures. Spring-run salmon transferred to Battle Creek also failed to survive because of temperature problems.

By 1946, the only elements of the original salvage program remaining were Coleman Hatchery and the Keswick trap. The original goal of these installations was to assist the displaced spring run and the early part of the fall run of salmon on the upper Sacramento River by providing additional spawning facilities. The steelhead trout resource was not considered. Since it soon became obvious that

spring-run salmon could not be handled successfully at Coleman, this facility became essentially *a* fall run hatchery and the spring run resource was left to fend for itself in the Sacramento River. No longer used to transfer spring-run salmon to other waters, Keswick trap was operated on occasion to supplement the numbers of fall-run salmon entering Coleman Hatchery via Battle Creek.

Coleman Hatchery became operable in 1943 and for its first years was staffed by the U.S. Fish and Wildlife Service, but funded by the Bureau of Reclamation. This arrangement was changed in 1949 when the Bureau and the Service signed an agreement transferring custody of the hatchery along with responsibility for its funding to the Service. The Bureau and Service tried to Justify the transfer of funding responsibility by claiming that, "...the salmon runs above Shasta Dam appear to have become established below the dam in numbers equal to the numbers existing before the dam was built..."

In the agreement, both the Bureau and Service acknowledged that "The continued maintenance of the Sacramento River salmon runs is recognized as one of the purposes of the Central Valley Project in operating Shasta Dam..." The Bureau agreed to continue to maintain the Keswick Trap.

Many changes in Coleman Hatchery's fish production programs and techniques have occurred in the more than 40 years Coleman has been in operation. The original objective of taking over 50 million eggs was achieved in only two years, 1959 and 1962. In 1973 less than 4 million eggs were collected. The average egg take has been less than 20 million (Figure 1). The goal of releasing swim-up fry to coincide with the out-migration of naturally produced fish in Battle Creek was soon discarded in favor of rearing fish to a larger size. The first steelhead eggs were taken in 1946 under a modest production program for what had been a neglected resource. Other small-scale projects, such as rearing Kamloops trout for planting in Shasta Lake and providing trout for military and Indian reservations, were initiated and later discontinued because of space or funding problems.

From time to time the hatchery has been modified and expanded with emphasis on disease control facilities. However, this has been done in piecemeal fashion because of budgetary constraints imposed by the Service. Fish cultural practices likewise changed as Coleman, like other hatcheries, replaced troughs and egg baskets with incubators. The availability of pelletized fish food, for example, eliminated the practice of grinding salmon carcasses for fish food and also permitted the use of automatic feeders. Some progress was made in achieving water temperature and water quality control, but more control is needed.

The current production objectives for Coleman Hatchery are reported to be 12 million fall chinooks at 90/lb.; 2 million late-fall chinooks at 40/lb.; and 1 million steelhead trout at 7/lb.; for a total weight of 326,000 pounds. If it were possible to realize

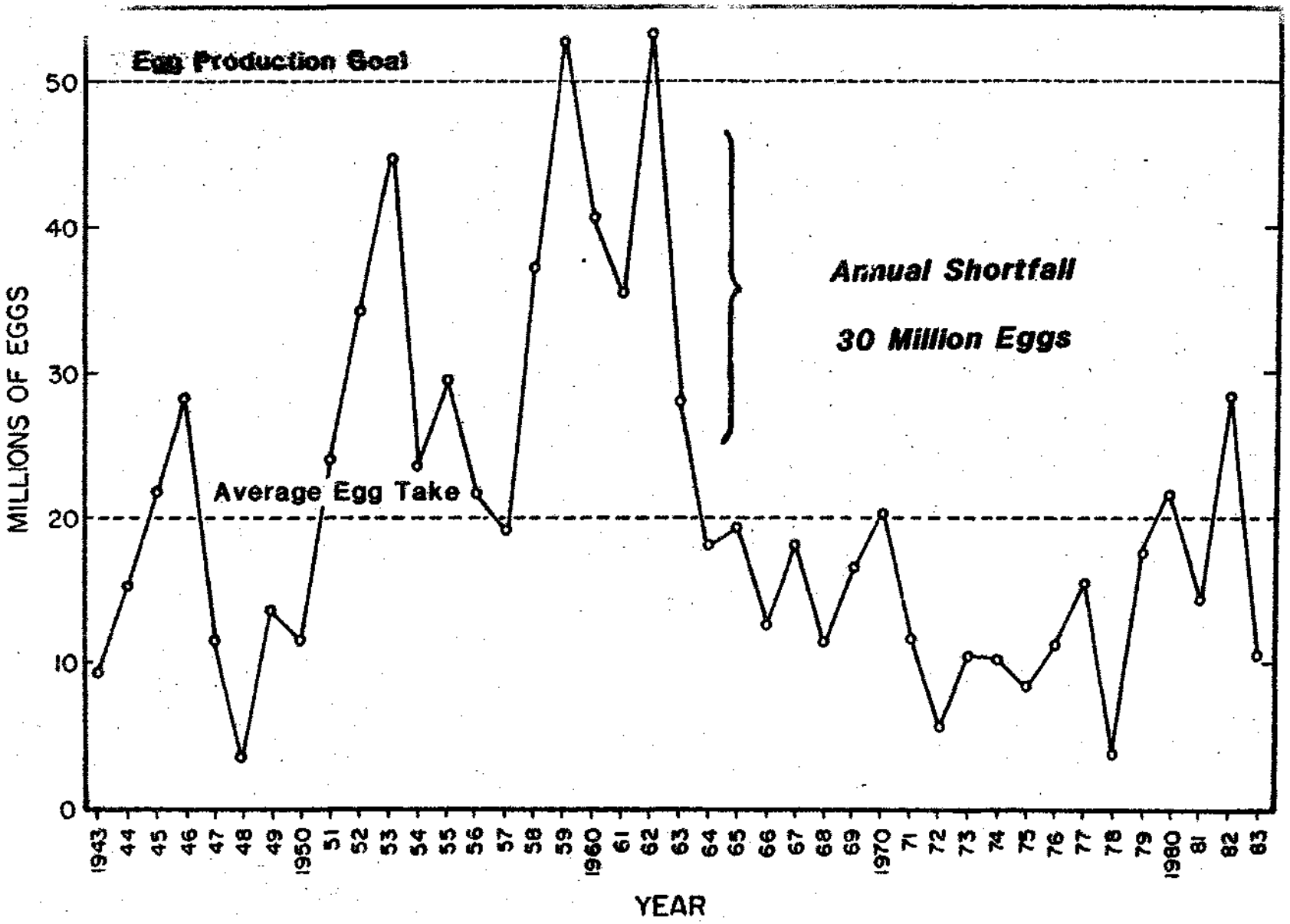

Figure 1. Salmon Egg Take, Coleman Hatchery, 1943-1983

production of this magnitude on an operating budget of $570,000 (1983 FY budget) the cost would amount to about $1.75/lb. This is considered a very reasonable figure for anadromous fish production.

The operation of Keswick Trap has been sporadic due to several factors: the condition of the trap, the flows discharged from Keswick Dam, and the number of salmon concentrated below the dam. In 1971, a Salmon and Steelhead Advisory Committee's report to the California Legislature complained that the trap was in poor repair and could only be operated at low flows. Again, in its 1975 report, the Advisory Committee stated that nothing had been done to improve the trap. Immediate corrective action was recommended. Subsequently, plans were prepared to modify the facility to permit trapping at flows up to 55,000 c.f.s. These were never implemented because the Bureau and the Service considered project costs excessive in terms of the benefits which would accrue. Today the trap only operates efficiently at flows up to 16,000 c.f.s.

Meanwhile, salmon counts at the Red Bluff Diversion Dam for the years 1967 through 1983 indicate substantial declines in the fall and late-fall runs, a serious decline in the spring run, and the almost complete loss of the unique winter run. Counts also show the steelhead resource is in desperate trouble (Table 1). The once viable steelhead sports fishery, supported largely by Coleman Hatchery production, has all but disappeared.

Coleman Hatchery has a significant role in sustaining the fall salmon run, a role that increases in importance as the salmon runs past Red Bluff decline (Table 2). Coleman also could play an important part in a plan to rebuild the depleted winter and spring runs if brood fish became available and chillers could be operated at the hatchery to reduce high summer water temperatures.

CONTEMPORARY PROBLEMS OF COLEMAN AND KESWICK

The problems at Coleman-Keswick consist of (1) inadequate funding, (2) water supply, (3) power costs, (4) physical plant conditions, (5) management policies and (6) the Keswick trap operation. To remedy these problems, FWS has developed a Station Development Plan which is discussed herein.

FUNDING

Despite its contributions toward maintaining and improving Sacramento River salmonid fisheries, Coleman Hatchery must operate on an annual budget of less than $600,000, an amount the committee feels is unrealistic. Economic, recreational, and environmental elements of the upper Sacramento River's fisheries have often been studied; a recent report by the Fish and Wildlife Service estimates current annual sportfishing benefits from Coleman Hatchery at about $3.7

TABLE 1. CHINOOK SALMON AND STEELHEAD COUNTS AT RED BLUFF DIVERSION DAM

Year	Fall	Late-Fall	Winter	Spring	Steelhead
1967	89,220[9]	32,891 [1 2]	49,533 [1 2]	23,441 [1 2]	15,375
1968	122,095 [9]	30,996 [2]	84,414 [2 3]	14,461 [2]	13,776 [4]
1969	133,815 [9]	8,899 [2 5]	117,808 [2 6]	26,471 [2]	10,995
1970	80,934	16,567 [2]	81, 159 [2 7]	3,652 [2]	10,574
1971	63,918	16,741	53,089	5,830	5,206
1972	42,503	32,651	37,133	7,346	7,678
1973	53,891	23,010	24,079	7,762	6,002
1974	59,958	6,300 [8]	19,116	3,932	5,084
1975	63,091	19,659	23,430	10,703	8,196
1976	60,719	16,198	35,096	25,983	5,928
1977	40,444	10,602	17,214	13,730	2,467
1978	39,826	12,586	24,862	5,903	3,487
1979	62,108	10,398	2,364	2,900	10,994
1980	37,610	9,481	1,156	9,896	2,898
1981	53,744	6,807	20,041	21,025	2,394
1982	48,431	4,913	1,242	23,438	3,294
1983	42,961	14,714	2,262	3,911	1,969

1/ 8-hour counts, adjusted for 14-hour counting period (x 1.75).

2/ Counts reconstructed by adjusting actual counts to their respective run each week using 1971-82 averages.

3/ Adjusted for missing counts (actual count 61,369).

4/ Adjusted for missing counts (actual count 6,389).

5/ 21-weeks of missing counts, run not adjusted.

6/ Adjusted for missing counts (actual count 80,934).

7/ Adjusted for missing counts (actual count 52,185).

8/ 6-week of missing counts, run not adjusted.

9/ Spawning escapement (does not include sport catch).

TABLE 2. RELATIONSHIP BETWEEN NUMBER OF FALL-RUN SALMON COUNTED AT RED BLUFF DIVERSION DAM AMD NUMBER RETURNING TO COLEMAN HATCHERY

Year	Count at R.B.D.D.	Return to Hatchery
1967	89,220	3,040
1968	122,095	3,551
1969	133,815	2,324
1970	80,934	3,266
1971	63,918	2,108
1972	42,503	2,822
1973	53,891	3,835
1974	59,958	2,175
1975	63,091	2,695
1976	60,719	2,971
1977	40,444	4,852
1978	39,826	1,872
1979	62,108	8,729
1980	37,610	7,733
1981	53,744	11,473
1982	48,431	19,454
1983	42,961	8,736

million, a figure that would rise to $5.4 million if proposed improvements are implemented. These figures do not take into account significant contributions to local economies.

Of perhaps greater significance, however, is the frightening possibility that an entire race of fish, such as the winter chinook salmon, may become extinct unless an effective restoration program is undertaken soon.

Since maintenance of salmon runs was one of the original purposes of the Central Valley Project, the hatchery logically should be funded by the Bureau of Reclamation, which manages the CVP. The Bureau has the duty to fully mitigate fishery losses, including funding of maintenance, operation, and expansion programs at Coleman, as it does at Trinity River and Nimbus hatcheries.

The fact that the funding burden falls on the FWS means that Coleman must compete for dollars with every other service facility in the nation. This policy permits the agency which caused the problem to evade financial responsibility for correcting it.

WATER

In order to fulfill a hatchery's designed salmon and steelhead production objectives, it must have an adequate supply of good quality water that helps the hatchery remain disease-free while generating good egg hatching and efficient growth of fish. Like many anadromous fish hatcheries, Coleman has suffered losses because of water.

The sources of water for Coleman are Battle Creek and deep wells. Even in the driest months of drought years, the creek has a mean daily flow of about 175 cubic feet per second (cfs) or more. In terms of quantity, this is generally adequate to meet existing Service production goals.

One of the major water quality problems at Coleman is the annual water temperature fluctuation. Part of the year, the water is too cold, which can result in poor hatching success and extremely slow growth of young fish. At other times, water at Coleman is too warm, which can result in accelerated pond mortality. To help partially overcome these problems, deep wells that produce warmer water when winter surface water is cold along with chillers that cool summer water that is too hot have been established at Coleman. Chillers compound hatchery operational problems and, as will be pointed out later, can greatly increase the costs of operation, especially for electrical energy.

Coleman has also had a history of disease problems. It is the first place that the Sacramento River Coldwater virus was found. To add to this and other disease problems, Coleman lies downstream from state and private hatcheries. If disease hits the upstream hatcheries, the pathogens can be carried downstream to Coleman.

The Coleman Station Development Plan —directed at improvements for Coleman Hatchery— has addressed some of these water problems. The Plan includes provisions for a sand trap to help improve water quality problems; an ozone generator to help control disease organisms; and both rehabilitation and development of water wells.

The Plan also calls for increased production at Coleman which will necessitate development of additional wells. The availability of new well sites should be fully explored.

POWER

Power is one of the biggest items in the Coleman budget. Before the Bureau turned the operation of Coleman over to the Service, project power was made available to the hatchery at no cost. After the Fish and Wildlife Service took over the operation, however, power became available only through PG&E, the budget for which is not sufficient. It is estimated that at current rates, power costs for operation of the chillers for just five months would be $450,000, which is well over one-half of the entire present annual budget for the hatchery. Late fall and winter run salmon cannot be maintained at the hatchery without operating the chillers during the warm months of the year. As a result of the refusal of the Bureau of Reclamation to provide the hatchery with project power, neither run has been maintained, and the winter run approaches extinction.

Because Shasta Dam was constructed in part for the production of power, and because it eliminated hundreds of miles of spawning area, the supply of power without charge to mitigate for the loss of that spawning area should be the responsibility of the Bureau. The Bureau has abdicated this responsibility. It should not be allowed to continue to do so.

PHYSICAL PLANT

The hatchery facilities consist of one main hatchery building, 58 raceways, several dwellings, and various accessory buildings and facilities. Many of the structures and facilities were constructed or acquired in 1942 and, besides being antiquated, require extensive and expensive maintenance. As one example, the hatchery is still using some redwood incubation troughs purchased in 1942 that are in an advanced state of deterioration.

There have been some improvements at Coleman over the years, including the addition of water chillers. Such improvements have amounted to fix-up, add-to and/or make-do projects.

MANAGEMENT POLICIES

Coleman is the only major hatchery on the Sacramento River which is operated by the federal government. Nimbus Hatchery on the American River as well as the Trinity River Hatchery, are operated under Bureau funding by the Department of Fish and Game. While the Service and the Department profess to work together to achieve their common goal, it is apparent that there are some basic differences in philosophy. Examples of differences in management philosophy relate to matters such as the size of fish to be released, release points, and the importation of eggs from outside the basin. The Service is charged with operating the hatchery, while the Department is charged with management of the fishery. Unless the two chart the same course, they can find themselves at cross purposes. Interagency coordination and cooperation, therefore, are of extreme importance.

A substantial number of agencies or private organizations have made studies of the fishery in the Sacramento River. They include the Service, the Department, the Bureau, the Corps of Engineers, and the Department of Water Resources. There does not appear to be any consolidation or coordination of those reports.

One of the recurring criticisms of federal management policy is its apparent lack of flexibility. A review of the returns of fish to the upper Sacramento River clearly shows a continuing decline, yet the management policies continue as they have for years. Runs of winter and spring salmon are declining at a disastrous rate, as are the runs of steelhead. In 1983, less than 0.2 of 1% of the steelhead crop that had been planted earlier returned to the river above Red Bluff Diversion Dam. It is acknowledged that there are myriad causes for this extremely poor result, but management policy decisions—not to be confused with the day-to-day management efforts by hatchery personnel—cannot be ruled out as one of the causes. It is time for imaginative and innovative change, and Fish and Wildlife Service should lead the way with a well-funded study that reappraises the original goals and the present results.

KESWICK FISH TRAP

The Keswick Fish Trap is located at Keswick Dam downstream from Shasta Dam. Keswick is the regulating reservoir for releases in the Sacramento River. The original purpose of the trap was to take fish blocked by the dams and transport them to Coleman or to Mill or Deer creeks for spawning. The number of fish trapped at Keswick has been small. As a mitigating factor for the loss of salmon spawning habitat, it has essentially been ineffective. It is not operational during high flows of water and may be considered as adding very little to the mitigation promised by the federal government.

STATION DEVELOPMENT PLAN

In December, 1983, the Service issued a draft Station Development Plan for Coleman. The plan has seven strategies which are:

1. Control disease
2. Control water temperature in an energy efficient manner.
3. Increase capacity to hold winter chinook.
4. Optimize production pond loading and smolt release.
5. Increase egg-to-smolt survival.
6. Plan, design and construct new propagation capacity.
7. Provide water temperature not exceeding 60°F.

The principal steps in achieving these strategies are:

1. Make major improvements in all water intake systems on Battle Creek.
2. Construction of a sand trap.
3. Install an ozone generator.
4. Install a heat exchanger and standby diesel generator.
5. Provide an additional source of well water.
6. Rehabilitate the fish diversion dam.
7. Install 96 incubators and 30 fiberglass tanks.
8. Construct new broodstock holding and spawning facilities, and construct pre-release ponds.
9. Expand pollution abatement facilities.
10. Replace fish food storage facility.
11. Rehabilitate roads and other hatchery elements.

The projected cost of the work is $6,365,000. The work would be done in three phases with each phase being completed before the next begins. The production objectives of the development plan are to produce smolts in the following numbers: 11,000,000 fall chinook; 1,400,000 late fall chinook; 2,000,000 winter chinook; 2,500,000 spring chinook; 1,300,000 steelhead. These numbers of smolts are expected to contribute adult fish as follows: 55,000 fall chinook; 10,000 late fall chinook; 15,000 winter chinook; 20,000 spring chinook; 5,000 steelhead.

In the committee's opinion, the development plan's objective for late fall-and winter run salmon and for steelhead are too low. The plan's objective of 10,000 late fall salmon represents a reduction from the current objective of 17,300 fish.

The Regional Resource Plan objectives of the Service call for a long term return of 20,000 steelhead to the river, which is 15,000 fish more than called for in the development plan.

The development plan should call for Coleman Hatchery to contribute annually to the fishery 20,000 late fall salmon, 20,000 winter salmon, and 20,000 steelhead. Achieving these objectives will require facilities, including tanks, raceways, and pre-release ponds, in addition to those now called for in the development plan.

Not only are some of the objectives called for in the development plan too modest, but the plan would also unnecessarily delay expansion and modernization of the hatchery. What is needed is an accelerated plan calling for single stage construction, with facilities designed to quickly bring help for the embattled fisheries, especially steelhead and late fall and winter run salmon. Although the exact cost of such a plan cannot now be determined with precision, it appears that the cost would probably be in the area of $10,000,000 rather than $6,365,000 estimated by the Service in the Station Development Plan. The additional cost would be negligible when measured against the value of the resources. In addition, an accelerated construction program would save most of the estimated annual 6% increase in construction costs.

The committee strongly recommends that a more extensive and accelerated development plan be prepared, funded, and implemented without delay.

CONCLUSIONS AMD RECOMMENDATIONS

1. The severe declines in the runs of salmon and steelhead since the construction of Shasta and Keswick Dams are due, in part to the loss of access to spawning gravel above Keswick Dam.

2. The Shasta Salvage Plan, which was undertaken in 1940 to par tially compensate for the elimination of spawning gravel above Keswick Dam, has for the most part been a failure. Of the measures undertaken pursuant to that plan, only Coleman Hatchery and the Keswick Fish Trap remain.

3. The Keswick Fish Trap can be operated only at low flows and is of relatively little use. The trap should be improved and modified so that it is operational at flows up to 55,000 c.f.s.

4. Coleman Hatchery was constructed in the early 1940s, and is now antiquated and incapable of carrying out its proper role in maintaining salmon and steelhead runs in the Sacramento River.

5. Coleman Hatchery does not have an adequate annual budget, and it does not receive project power from the Bureau of Reclamation. Without either project power or an addition to its annual budget of more than $450,000, the hatchery cannot operate the chillers for a sufficient length of time to produce sufficient numbers of steelhead and late fall and winter run salmon. As a result, these runs are now in grave danger. The winter salmon run is on the brink of extinction.

6. The Bureau of Reclamation, through the Central Valley Project, should immediately begin supplying Coleman Hatchery with project power at no cost to the hatchery.

7. In addition, the Bureau of Reclamation should provide annual funding for Coleman Hatchery as part of the Central Valley Project annual budget. This funding should probably be between $1,000,000 and $1,500,000 depending on whether the hatchery receives project power.

8. The Station Development Plan prepared by the Service for the rehabilitation of Coleman Hatchery is good plan, but it does not go far enough fast enough.

9. The Station Development Plan's objectives for late fall and winter run salmon and for steelhead should be increased to call for a contribution to the fishery of 20,000 late fall salmon, 20,000 winter run salmon, and 20,000 steelhead.

10. The Station Development Plan should be revised to call for single stage construction with adequate facilities to meet the above objective for late fall and winter run salmon and steel head.

11. An emergency program should be immediately undertaken to pre serve the remaining remnants of the winter salmon run.

12. Even though an expanded and modernized Coleman Hatchery cannot by itself fully compensate for the fishery losses caused by the construction of Shasta Dam and Keswick Dam, much less return the salmon and steelhead runs to their historic levels, an expanded and accelerated development plan, together with project power to the hatchery and adequate operational funding, will permit the hatchery to assume its proper role in helping bring salmon and steelhead runs back to their pre-1940 levels. This effort should be undertaken, and undertaken without delay.