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# STRATEGIES FOR RECOVERY OF SNAKE RIVER SALMON

## RECOMMENDATIONS FOR ENDANGERED SPECIES ACT PRE-DECISIONAL MANAGEMENT PLAN

SUBMITTED BY STATE OF IDAHO
CECIL D. ANDRUS, GOVERNOR

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November, 1990

To the Citizens of the Pacific Northwest:

Idaho submits the following information to stimulate and facilitate the development of alternative strategies to assist in the recovery of Snake River salmon stocks presently being reviewed under the Endangered Species Act.

The Snake River salmon runs being reviewed under the Endangered Species Act are an irreplaceable, renewable resource of great value to Idaho, the Pacific Northwest and the nation. There is no better symbol than the salmon that identifies this part of America as a region. Our once-productive salmon runs are in serious trouble. The loss of fishing opportunity has had serious adverse impact on Idaho's tribal and nontribal citizens and on the associated economic benefits of fisheries.

The major causes of this problem have been obvious for many years, notably the loss of juvenile migrant salmon and steelhead at federal main-stem dams and overfishing of progressively smaller numbers of returning adult fish. Idaho has not enjoyed a general salmon fishing season since 1977 despite major hatchery programs, protection of free flowing rivers like the Salmon and Clearwater, and vast areas of natural habitat, much of which is in wilderness or otherwise protected.

As you will note in the following pages, improving juvenile fish survival at the eight federal main-stem dams between Idaho and the ocean is pivotal to recovery of Snake River salmon runs being reviewed under the Endangered Species Act. Appropriate limits on mixed stock fisheries also are required to ensure sustained recovery of fish runs. The ultimate goal must be sustainable, fishable populations of salmon in Idaho.

At the same time, we must protect the general economy of our region. Accordingly, all potential remedies should be evaluated in light of their probable effectiveness and cost to the region. In addition, the legal, social and environmental aspects must be evaluated. Some suggested

alternatives will no doubt require consideration under provisions of Idaho water law.

The concerns many of us have about the impacts of listing are valid, but it is imperative that we view the Endangered Species Act process not as a threat, but as an opportunity to renew our stewardship commitment to Snake River salmon and steelhead runs and to present and future generations of Northwesterners. This problem can be solved with creativity, intelligent investments and commitment to achievable objectives. Rebuilding the Snake River runs will not come without costs to the region. All citizens of this region must share equitably the costs and contribute to the efforts to rebuild the Snake River runs.

As always, Idaho stands ready to do its part.

Sincerely,

Cecil D. Andrus
Governor

CDA:ab1

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# EXECUTIVE SUMMARY

## INTRODUCTION

The State of Idaho's long-time goal has been to rebuild our anadromous fish runs so there are sustainable fisheries. Idaho has displayed a long and consistent concern for Snake River origin anadromous fish. A general sport-fishing salmon season has not been allowed since 1977. Nez Perce and Shoshone-Bannock tribes have restricted tribal harvests in order to protect the fish. Idaho has implemented a water resource plan and a water quality program aimed at protecting habitat and migration needs. Idaho has also gone to federal court four times on behalf of anadromous fish. Notwithstanding these efforts of the state of Idaho, several important anadromous species are extinct, or close to it.

Snake River coho are extinct, sockeye are nearly gone and fall chinook are not far behind. The loss of these species is largely attributable to one thing--the construction and operation of dams on the Columbia and lower Snake rivers.

## MAIN-STEM PASSAGE

Contrary to Congressional intent, the eight federal main-stem dams on the lower Snake and Columbia rivers were not properly designed to pass juvenile migrant salmon and steelhead. Large numbers of juvenile fish perish in the slack water reservoirs behind these dams. Additional mortalities occur as fish attempt to pass over or through the dams. Mortalities as high as 95 percent of all Idaho-produced fish have been documented by the region's fisheries agencies.

Add-on measures, such as collection and transportation and turbine intake screens, have failed to reduce juvenile fish mortalities sufficiently to ensure survival of Snake River salmon stocks, or to maintain hatchery stocks at productive levels. Wild stocks have been reduced to such critically low levels that traditional mixed-stock fisheries over- fish these depleted wild stocks.

Improving juvenile survival requires improving juvenile bypass efficiency at the federal dams and increasing the velocity of streamflow through the reservoirs. The latter is critical to the former.

These things can be accomplished by modifying some project features, changing the operation criteria of the federal hydroelectric projects, and by increasing the volume of water during critical migration periods. At the same time we must protect the general economy of our region. Accordingly, all potential remedies should be evaluated in the light of their probable effectiveness and cost to the region. In addition, the legal, social and environmental aspects must be evaluated.

The Northwest Power Act requires protection, mitigation and enhancement of Snake River fish runs while maintaining an economical and reliable power supply. Achieving this objective for the fish now requires financial resources that would not have been necessary if adequate measures for fish protection and enhancement had been implemented in the past. The commitment of these financial resources is unavoidable if the region is to enjoy the benefit of a salmon fishery along with hydroelectric production. Over time, these short-term costs can be absorbed by the region as system operations provide both fish flows and energy, as intended by the people of the Northwest and the nation. The net result of both energy and fish runs will be a dramatic increase in long-term regional economic diversification, productivity and quality of life.

Near-term Recovery Actions (within one to two years)

1] Operate main-stem hydroelectric projects to increase velocity of streamflow through the reservoirs (and minimize the volume of flow necessary to achieve desired survival rates). This may require periodic shutting down of hydropower operations and scheduling of water transportation pending modification of project features and permanent operational changes (see Long-term Recovery Actions).

2] Adjust and augment streamflows during critical migration periods through the following means:

A. Change power production rule curves. Reduce winter generation to reserve water for release in spring and summer migration periods.

B. Modify flood control rule curves at Brownlee and Dworshak Reservoirs; transfer flood control responsibility to Columbia River reservoirs.

C. Obtain uncontracted, uncommitted, and contracted storage space for fish.

--Use the 4.5 million acre feet of non-treaty storage in Canadian reservoirs to directly enhance Columbia River flows below the

mouth of the Snake River, and to indirectly enhance lower Snake River flows by displacing power generation at Brownlee and Dworshak.

--Evaluate use of uncontracted space in Lake Roosevelt behind Grand Coulee Dam to increase Snake River juvenile fish survival by enhancing lower Columbia River streamflows, and to improve lower Snake River flows by displacing power generation at Brownlee and Dworshak.

--Evaluate limited use of uncontracted space in Bureau of Reclamation reservoirs above Brownlee as an interim measure contingent upon binding commitments to treat juvenile survival problem at the main-stem dams, and binding commitments to limit ocean and main-stem harvest of Idaho-bound salmon and steelhead.

--Lease or purchase contracted space in reservoirs above Brownlee from willing space holders.

**Long-term Recovery Actions**

1] Permanent modification of system operations of the federal dams on the Columbia and lower Snake rivers is critical to a sustained recovery of Snake River stocks. Therefore, a hard constraint must be placed on operating the federal dams to increase the juvenile fish survival rate.

2] Establish independent panel of f experts to evaluate system operations and design features on the main-stem hydroelectric projects to pass juvenile fish as originally intended. Idaho first proposed this in 1980.

3] Construct new storage in Snake River Basin above Brownlee Reservoir as necessary to supplement juvenile survival improvements from Near-Term Recovery Actions. Dedicate by statute to fish flows. For example, the Galloway project on the Weiser River would provide 750,000 acre feet of storage.

4] Investigate creative NW-SW energy exchanges to facilitate improved main-stem flows.

5] Investigate potential yield of water to enhance streamflows by financing irrigation efficiency improvements in Snake River Basin above Brownlee Reservoir.

6] Investigate the potential for facilitating improved main-stem flows by fuel switching, i.e., from electricity to natural gas for future space heating loads.

7] Investigate the potential for facilitating improved main-stem flows through energy demand management and creative marketing strategies.

Collectively these actions can be employed to improve juvenile fish survival at main-stem Columbia and Snake River dams to levels that will restore and sustain the petitioned Snake River stocks at productive levels, and prevent other stocks from being petitioned for listing.

A least-cost mix of these actions can achieve the objective of the Endangered Species Act and the dual objective of the Northwest Power Act to maintain an economical and reliable power supply while restoring critically depressed fish runs and dependent economies.

**PRODUCTION**

**Natural**

Neither the depressed populations, nor the recovery of Snake River salmon are related to the quantity or quality of natural production habitats in Idaho. Vast areas of potentially productive habitat are available. Chronic high mortalities of juvenile fish result in insufficient adult fish to utilize the available habitat.

**Near-term Recovery Actions**

1] Establish as hard constraint on operation of federal main-stem hydroelectric projects a juvenile survival rate for natural and wild fish that will allow populations to rebuild and utilize existing habitats.

2] Implement Main-stem Passage Near-Term Recovery Actions.

3] Implement the restoration plan to improve production of spring chinook, sockeye and steelhead above Busterback Ranch on the upper Salmon River.

4] Increase funding to complete irrigation ditch screening in the Salmon, Clearwater and lower Snake sub-basins to prevent migrating juveniles from being diverted from tributary streams into canals.

5] Support Forest Service efforts to restore South Fork Salmon River summer chinook habitat.

6] Develop techniques for positive identification of hatchery- and naturally-produced fish.

Hatchery

Hatcheries have a very limited role in the recovery of the petitioned wild stocks.

More hatcheries are not to answer. Low smolt-to-adult survival has prevented existing hatcheries from meeting production goals or mitigation objectives.

Existing hatchery operations must be critically reevaluated for their potentially adverse impact on the preservation and recovery of imperiled wild stocks.

Improved survival of current hatchery production is needed to provide additional known stock for tribal and non-tribal known-stock harvest opportunities in Idaho pending recovery of wild stocks.

Improved survival and rebuilding of wild stocks are critical to long-term productivity of hatchery stocks and to reduce the risk of wild stock genetic deterioration and eventual extinction-by-dilution.

**Near-term Recovery Actions**

1] Establish as hard constraint on operation of federal main-stem hydroelectric projects a juvenile survival rate that will allow hatcheries to achieve mitigation objectives in parallel with improved natural production.

2] Construct smolt acclimation facilities on the East Fork and South Fork Salmon rivers to reinforce homing and minimize straying and interbreeding of hatchery fish with natural and wild populations.

3] Critically evaluate existing hatchery operations/ supplementation programs to minimize interbreeding of hatchery and natural fish with wild fish.

4] Establish genetic sanctuaries.

Long-term Recovery Actions

1] Intensify research aimed at reducing early migration mortality of hatchery smolts.

2] Develop improved techniques for positive identification of hatchery- and naturally- produced fish.

**HARVEST**

Chronically high juvenile mortalities at federal main-stem dams have reduced wild and natural Snake River salmon stocks far below fishable levels throughout their range. In Idaho, even hatchery stocks are not fishable except occasionally in limited terminal areas.

Harvest rates on petitioned stocks have been sharply reduced; in Idaho harvest has, for all practical purposes, long been eliminated.

Additional harvest restrictions in marine and Columbia River mixed stock fisheries will provide necessary short-term relief to some stocks. Significant, long-term improvements in productivity will require significant improvements in juvenile survival at and between main-stem dams coupled with limits on mixed stock harvest rates.

**Near-term Recovery Actions**

1] Establish for all petitioned stocks escapement levels that are hard constraints on harvest.

2] Establish independent panel of experts from international fishery community to evaluate known stock equipment for main-stem Columbia River fisheries.

3] Identify opportunities for shifting some main-stem Columbia River harvest to tributaries pending recovery of petitioned wild stocks

4] Establish more intensive ocean monitoring to identify weak stocks and allow targeting strong stocks. Weak stocks such as Snake River spring, summer and fall chinook should be fully protected upon entering the Columbia River.

5] Transfer significant portion of treaty commercial fishery on fall chinook to below Bonneville Dam to reduce impact on wild A- and B-run steelhead which have declined precipitously in recent years. This action might avert petitions for listing these stocks under the Endangered Species Act.

Long-term Recovery Actions

1] Develop improved techniques for identifying Snake River salmon and steelhead stocks in mixed stock runs and fisheries.

2] Conduct stock migration research to identify behavorial patterns of petitioned stocks and allow shaping fisheries to optimize escapement.

3] Replace the anachronistic Columbia River Compact with a regional harvest coordination entity which provides all producing and regulatory jurisdictions with equitable representation. Adopt equitable allocation principles.

Collectively the preceeding recovery actions can improve juvenile fish survival at main-stem dams to levels that will restore and sustain the petitioned Snake River salmon stocks at productive levels. These actions also will benefit all other salmon and steelhead stocks originating above Bonneville Dam and potentially avert petitions to list other stocks under the Endangered Species Act.

The Idaho Department of Fish and Game collaborated with Idaho Indian tribes, and other tribes and fisheries management agencies in the Columbia Basin to develop production and survival plans for the basin's anadromous fish re-sources. This project was supported by the Northwest Power Planning Council as part of its fish and wildlife program authorized under the Northwest Power Act. Technical activities included identification of critical mortality factors acting on salmon and steelhead populations.

These mortality factors are those related to hatchery production, to main-stem Snake and Columbia river hydroelectric system juvenile and adult migration, to ocean and Columbia River fisheries harvest, and to natural mortality. In order of significance to survival of wild Snake River spring, summer and fall chinook, the greatest losses are generally attributed to main-stem hydroelectric system migration, natural ocean mortality and harvest, respectively.
(Table 1).

Additional mortality related to hatchery production is the loss of smolts after release from hatcheries and prior to their arrival at the mainstem hydroelectric system at Lower Granite pool. Losses are believed to be associated with the hatchery rearing environment, although the mechanism of loss is poorly understood.

Natural ocean and estuary mortality includes all mortality not measurable and attributed to any of the other factors. This is likely an overestimate. Such things as improved hatchery fish health and migration conditions (physical health, synchronized estuary arrival and smoltification) would likely result in improved ocean and estuary survival.

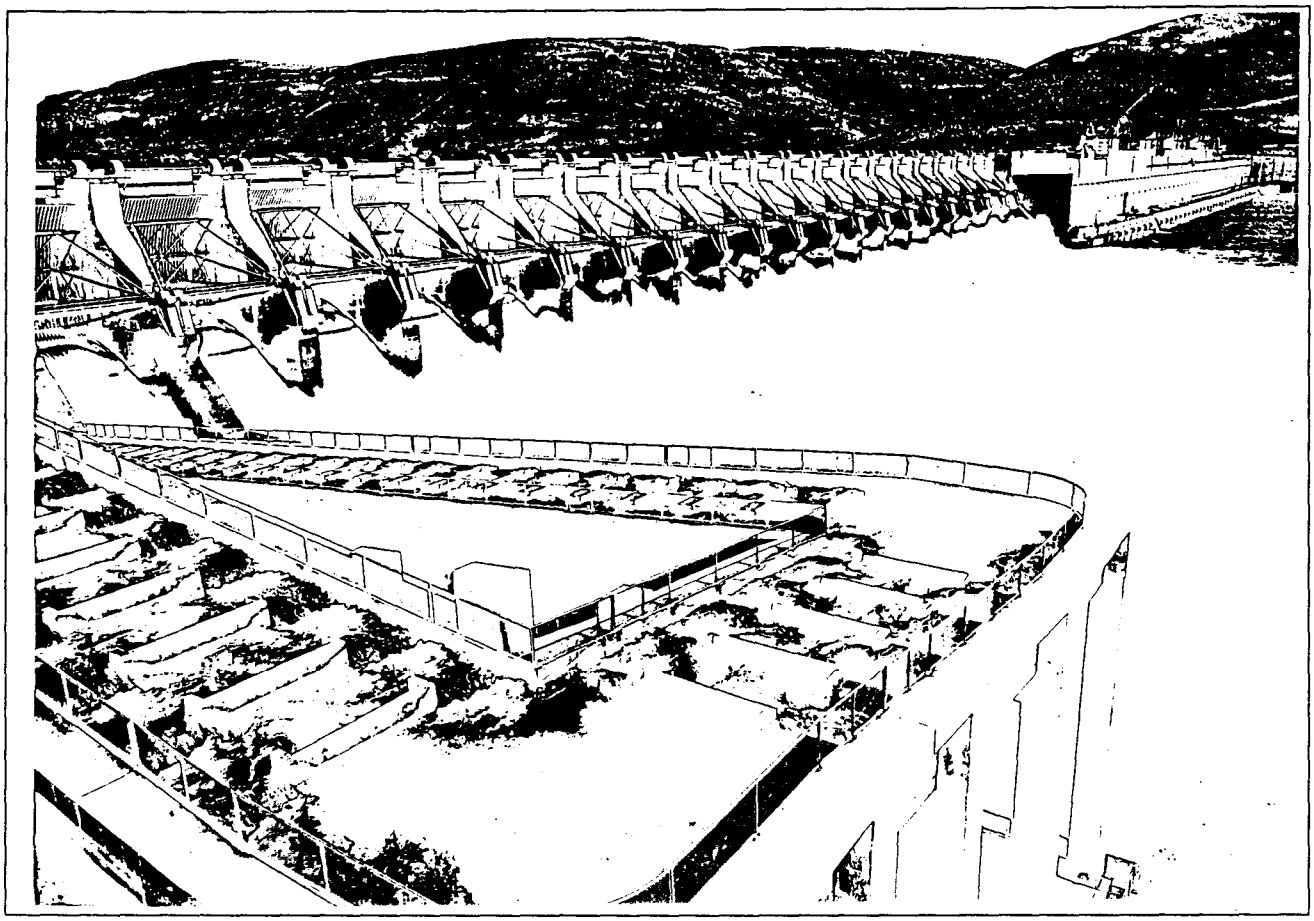
TABLE 1 . MORTALITY ASSOCIATED WITH VARIOUS LIFE HISTORY EVENTS OF SNAKE RIVER SPRING, SUMMER AND FALL CHINOOK SALMON. MORTALITY IS EXPRESSED AS THE PERCENT OF THE SMOLTS PRODUCED THAT ARE LOST DUE TO EACH EVENT.

| | Spring & Summer | | Fall |
|---|---|---|---|
| Modality Category | Hatch. Smolts | Wild Smolts | Natural Smolts |
| Hatchery to Hydroelectric System | 46.0 | 0.0 | 0.0 |
| Hydroelectric System, Juvenile Migration' | 28.4 | 52.5 | 56.0 |
| Ocean/Estuary Natural Mortality | 25.2 | 46.6 | 37.7 |
| Ocean Fisheries' | 0.04 | 0.08 | 3.1 |
| Hydroelectric System, Adult Migration' | 0.2 | 0.3 | 0.8 |
| Columbia River Fisheries' | 0.03 | 0.08 | 1.4 |

'Man-caused modality: As much as 99.7 percent of man-caused mortality of wild spring and summer chinook, and 92.7 percent of naturally produced fall chinook occur at main-stem hydroelectric dams and reservoirs.

Source: IDFG

# MAIN-STEM PASSAGE



CHRONIC **HIGH** MORTALITIES of juvenile fish at and between the eight federal main-stem Columbia and Snake River dams between Idaho and the Columbia River estuary (Figure 1) contribute to the imperiled status of the petitioned Snake River stocks. These mortalities put at risk the long-term productivity of both naturally-produced and hatchery-produced Snake River salmon. By severely reducing the naturally-produced component of the runs, juvenile fish mortalities at main-stem dams exacerbate overfishing of naturally produced fish intermingled with hatchery fish in traditional mixed-stock fisheries.

Under particularly adverse conditions, annual mortalities at and between main-stem dams have been documented as high as 95 percent of all juvenile fish produced in the Snake River Basin above Lower Granite Dam, uppermost of the four lower Snake River main-stem dams (IDFG). These high rates of juvenile mortality result from a number of factors working in synergy.

Despite long-standing public policy, the main-stem dams were not designed to pass juvenile fish. Four of the eight dams have been retrofitted with turbine intake screens and juvenile fish bypass

systems; the remaining projects are scheduled to be screened.

Screens and bypass systems improve juvenile survival, but are relatively inefficient due to inherent design flaws in the dams vis-a-vis juvenile fish passage. Large numbers of juvenile fish are killed at each dam, screens and bypass systems notwithstanding.

In 1983, Idaho filed suit against Bonneville Power Administration's proposed expansion of the NW-SW intertie, arguing that BPA was reducing flexibility to improve juvenile fish survival. A settlement agreement resulted from that lawsuit and provides for spilling water and juvenile fish until all dams are screened. The Army Corps of Engineers did not sign the agreement, and refuses to commit to spill except on an annual basis.

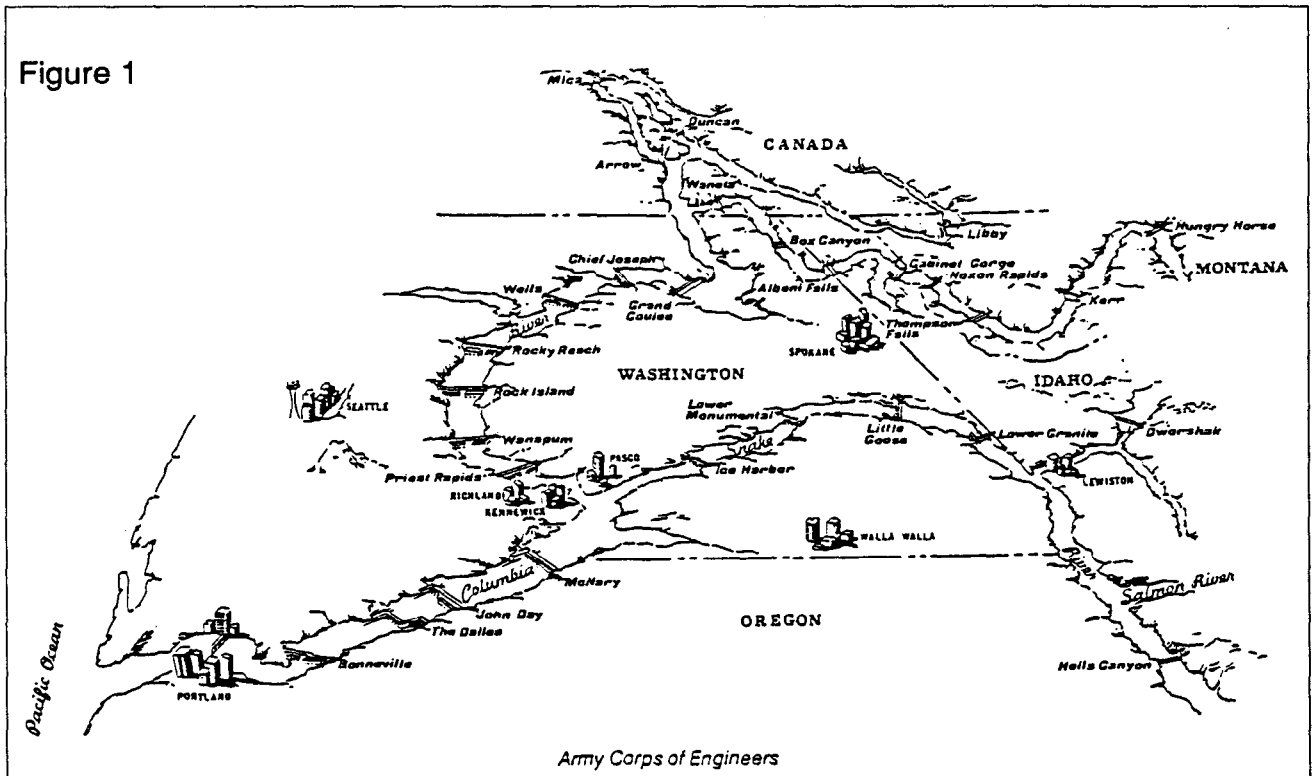
Large numbers of juvenile fish are collected at certain dams and transported in barges to the Columbia River estuary. Collection and transportation apparently has improved survival of hatchery steelhead compared to non-transported fish, but has had only marginal benefits for the relatively more fragile hatchery and wild chinook.

Large numbers of juvenile fish also die in the slack water reservoirs impounded by the main-stem dams. Juvenile salmon and steelhead rely on the current to carry them from headwater rearing areas through the main-stem Snake and Columbia Rivers to the ocean. They have a relatively short time to complete the transition from fresh to salt water. If delayed too long in the slack water reservoirs, they lose their urge to migrate and ultimately fall victim to predators, high water temperature and disease. .

During years of relatively low runoff, there is little current through the main-stem reservoirs; frequently not enough to carry juvenile fish to the dams on a timely basis where they can be bypassed or collected and transported.

Improper design and operation of the main-stem dams is further complicated with upstream water development. Although storage reservoirs capture and store for irrigation, flood control and power production some of the spring runoff that once flushed juve-

Figure 1




Army Corps of Engineers

nile fish quickly from headwaters to the Columbia River estuary, the resulting reduced streamflow in the lower Snake River would not pose a problem for migrating salmon and steelhead in the absence of unfavorable passage conditions at and between the main-stem dams.

Improper design and operation of the main-stem dams results in chronic mortalities that threaten survival of wild salmon and steelhead populations and of hatchery populations. Hatchery-produced populations of chinook are chronically depressed to below, or occasionally just above, maintenance levels. Only hatchery steelhead continue to return at fishable levels, and this varies dramatically depending on streamflows during the corresponding juvenile out-migration and August-September adult migration period.

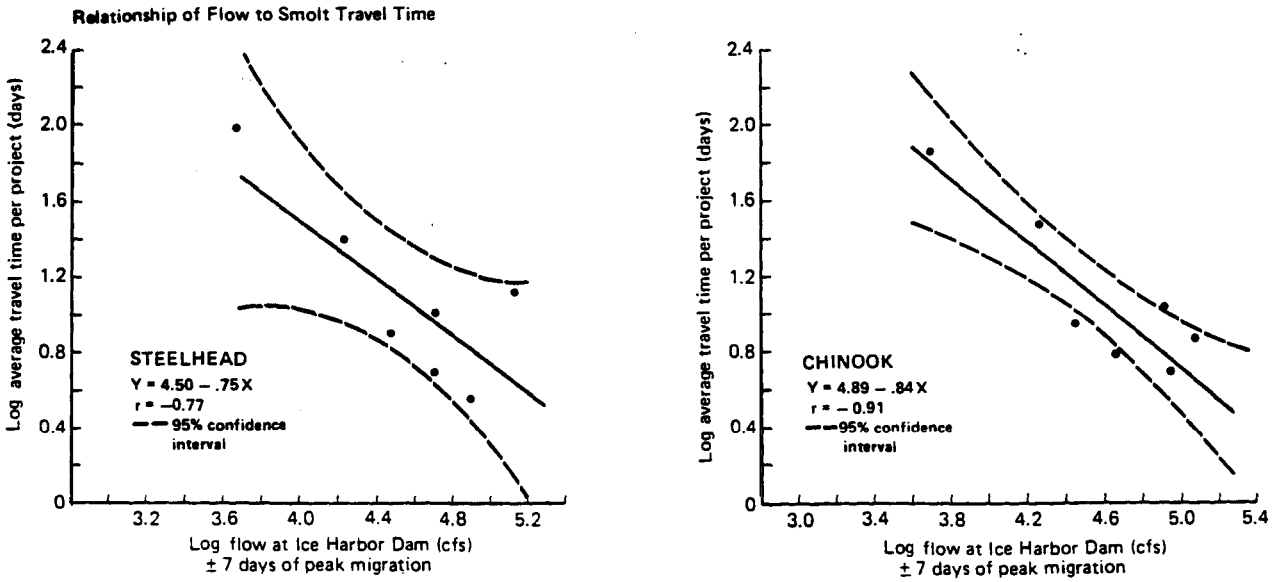
One study assessed the relationships between lower Snake River stream velocity and juvenile survival/adult returns. Figure 2 shows the relationship of juvenile survival to smolt travel time which is an expression of streamflow velocity through the main-stem reservoirs; in short, increased velocity results in increased survival.

Figure 3 shows the relationship of smolts to returning adults at different water volume levels. The number of wild spring chinook returning to Middle Fork Salmon River spawning grounds indicates a juvenile survival-to-adult return rate of 0.001 percent for main-stem Snake River flows averaging 40,000 cfs, 0.3 percent for flows averaging 85,000 cfs, and 1.2 percent for flows averageing 140,000 cfs. Similar relationships have been documented for South Fork Salmon River hatchery-produced summer chinook.

Given the present design and operation of the main-stem dams, fishery interests suggest lower Snake River flows of 120,000-140,000 cubic feet per second would be necessary to ameliorate the unfavorable passage conditions. Yet it is very questionable whether the optimum volume of water exists every year and can be physically delivered to the right place at the right time. To rely on an undependable water source year-to-year to overcome the effects of the lower Snake and main-stem dams does not make sense. It is apparent that the Columbia Basin Fish and Wildlife Authority flow proposal looked only at water volumes and not at other ways to induce increased water velocity.

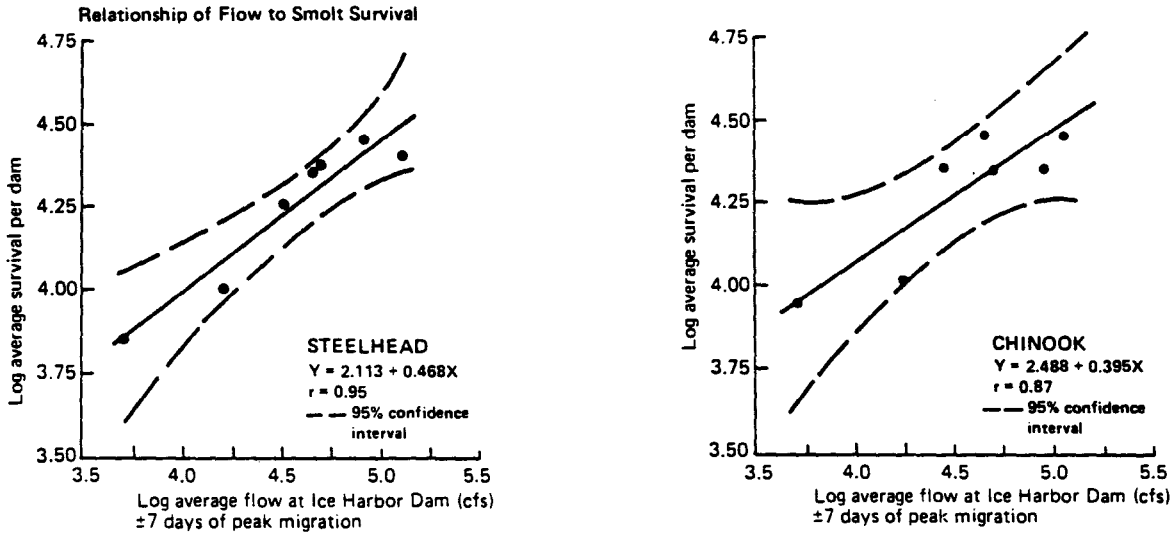
Less water volume would be required if the main-stem projects were operated to increase velocity of streamflow through the reservoirs and if

Figure 2




Regression line for flow at Ice Harbor Dam[1] and travel time from the Upper Snake River dam to The Dalles Dam for Snake River yearling chinook salmon and steelhead smolts, 1973-79.

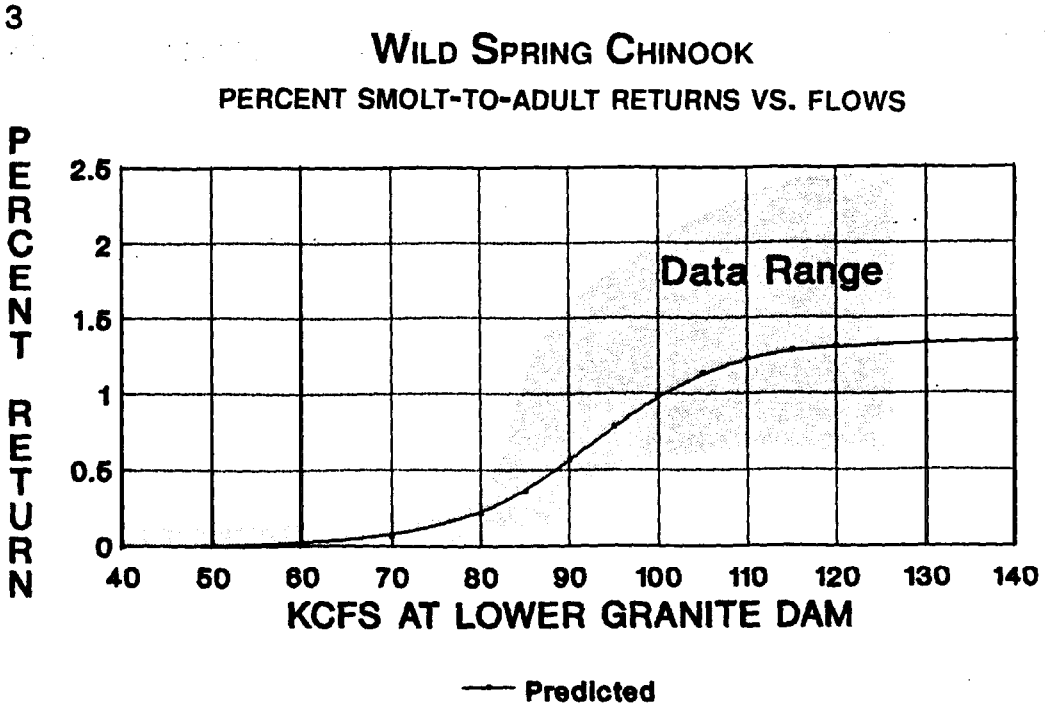
[1]At migration peak plus or minus 7 days.



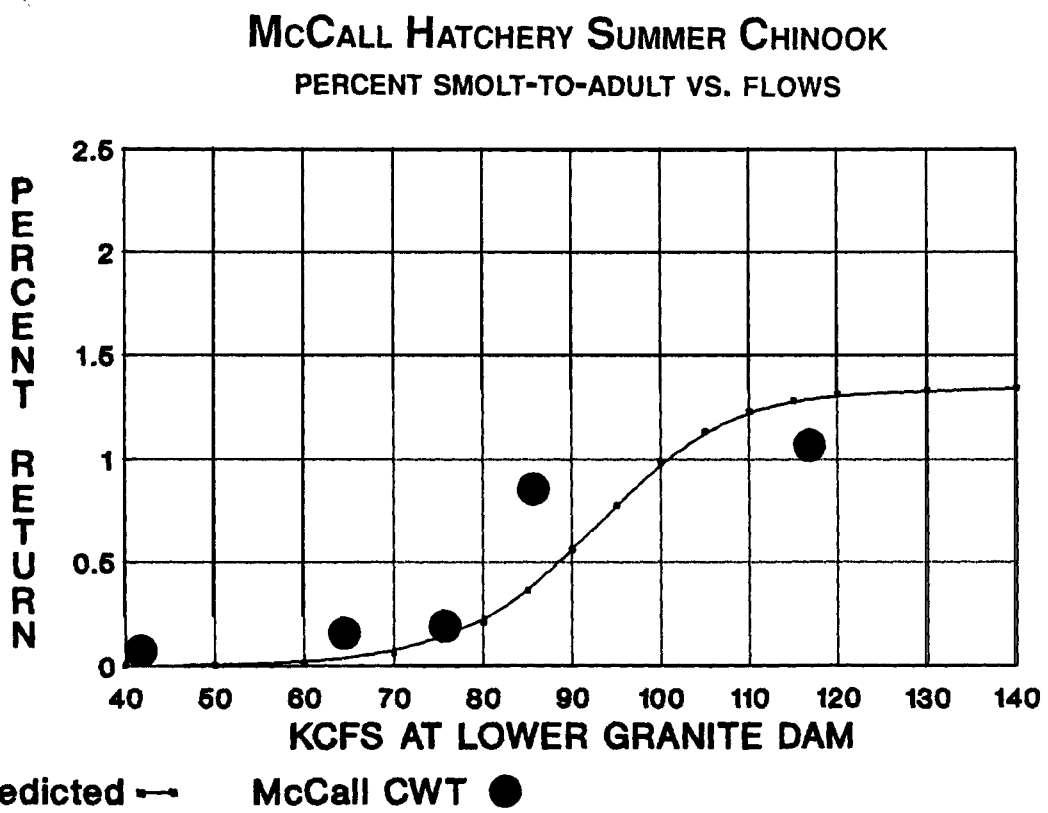

Regression line for river flow at Ice Harbor Dam and survival of Snake River yearling chinook salmon and steelhead smolts, 1973-79.

Source: Sims and Ossiander, 1981.

Figure 3




(April 15 - May 5)



***"...It is the oft repeated thesis of the Fish and Wildlife Service that the losses imposed by successive dams are cummulative to salmon migration both upstream and downstream.***

***"If we are successful in passing the fish over the proposed new dams on the mainstem of the Columbia, we will do so with an indeterminate but significant loss. If these survivors are then confronted with a series of four dams in the Snake there is the strongest doubt that these obstacles can be overcome.***

***"There is virtual assurance that only a fraction of existing runs could be gotten to the spawning grounds in the Snake River system, and that the progeny of this fraction would suffer further loss in its return movement to the sea"***

--Director, U.S. Fish and Wildlife Service, 1946

juvenile bypass facilities were redesigned to operate at greater ranges in reservoir elevations. This approach would also be reliable in critical water years.

## The Water Budget

Chronic high juvenile mortalities at main-stem dams were the principal impetus for fish and fishery restoration mandates in the Pacific Northwest Electric Power Planning and Conservation Act of 1980. The resulting Columbia River Basin Fish and Wildlife Program gave high priority to resolving this problem. The equivalent of 1.19 million acre feet of water was "budgeted" to enhance main-stem Snake River flows during the juvenile migration period.

The amount of water budgeted was substantially less than recommended as necessary by the region's state, federal and tribal fisheries agencies. In practice, the amount of water actually provided (450,000) acre-feet) has been substantially less than budgeted.

The inadequacy of the present water budget is particularly acute in years of below-averge runoff, when streamflow enhancement is needed the most to ameliorate unfavorable passage conditions at the main-stem dams.

In 1987, for example, the Water Budget provided enhanced flows for only 11 days of the April 15-June 15 migration period; flows exceeded 85 kcfs only 5 of those days and never reached 120 kcfs. In 1988, flow augmentation was available for only 7 days and main-stem flows exceeded 85 kcfs for 1 day during the critical April-June migration period. In 1989 enhanced flows were available for 17 days and exceeded 85 kcfs 25 days. In 1990, 25 days of water budget flows were provided; flows exceeded 85 kcfs--but were less than 90 kcfs--3 of those days. (NWPPC)

## Summary

The profound effect of Army Corps of Engineers' main-stem dams and reservoirs on juvenile salmon and steelhead survival has been recognized since at least the 1940s. Nonetheless, the dams were not designed to pass juvenile fish.

Add-on measures such as turbine intake screens and collection and transportation have failed to reduce juvenile mortalities sufficiently to ensure survival of Snake River wild stocks or to maintain hatchery stocks at productive, fishable levels. Chronic, high mortality of juvenile wild fish has reduced the wild component of the runs to such low levels that traditional mixed stock fisheries are causing a further decline in these runs.

Columbia River Basin state, federal and tribal fisheries agencies give top priority to increased main-stem flows timed for juvenile salmon and

steelhead migration. Achieving this objective requires improveing juvenile bypass efficiency at the dams and increasing the velocity of streamflow through the main-stem reservoirs. The latter, which is critical to the former, can be accomplished by a combination of actions, including changes in the way the main-stem hydroelectric projects are designed and operated and by increasing the volume of water available to augment streamflows during the juvenile migration period.

### Near-term Recovery Actions

*1] Change operations of main-stem reservoirs.*

The most direct way to increase the velocity of streamflow through the main-stem reservoirs is to draft the reservoirs. An Army Corps of Engineers document shows a drafting regimen would dramatically increase velocity (by two to four times) in parts of Lower Granite Reservoir. Drafting would be complicated because these projects were not designed to pass juvenile migrant salmon and steelhead. They have relatively small hydropower operating ranges, approximately 5 feet for each of the four lower Snake River projects. Retrofitted juvenile bypass systems were designed to fit hydropower operating ranges. If reservoirs are drafted below the minimum hydropower operating range, juvenile bypass and collection facilities become inoperable. Two of the lower Snake River dams do not have juvenile bypass facilities.

Drafting and holding the main-stem reservoirs at the lowest level that would allow bypass and collection facilities and powerhouses to remain operational would increase velocity of streamflow and would reduce the amount of additional inflow needed to achieve the necessary juvenile survival rate. A variation of drafting would be to sequentially draft and refill ("pulse") the main-stem reservoirs. In this mode, for example, the pool behind Lower Granite Dam would be quickly drafted to the lowest operating level, increasing flow into the next reservoir which would be similarly drafted, and so on in sequence. This approach could sequentially increase velocity of streamflow through the four lower Snake River reservoirs. However, it necessarily requires refilling in order to repeat the cycle. During refill velocities would be reduced. Investigation of this operational mode is the subject of a proposed study.

In summary, drafting the four lower Snake River reservoirs would reduce the volume of water required to achieve the necessary juvenile survival rates. However, even a best-case drafting scenario may not obviate the need to periodically shut down hydropower operations and/or increase the volume of streamflow during the juvenile migration period.

*2] Augment streamflow*

There are a number of promising immediate and near-term initiatives that in combination with drafting main-stem reservoirs could achieve the necessary juvenile survival through lower Snake River reservoirs. A comprehensive system analysis is required to quantify the potential yield of water from these initiatives, individually and synergistically, to augment streamflow during the juvenile migration period.

These should be considered interim measures, and would require modification of water rights. Binding commitments to treat the juvenile fish survival problem at main-stem dams, and long-term binding commitments to limit ocean and main-stem harvests of Idaho-bound salmon and steelhead are also necessary.

*A. Modify hydropower production rule curves*

Modification of power production rule curves at Brownlee and Dworshak Reservoirs could result in substantial increases in lower Snake River flows/ juvenile survival. Reduced reservoir releases in winter for power production would result in more water in storage for release during the juvenile migration period. Replacing the forgone winter generation would require load shifting within the coordinated system.

Modification of power rule curves on Columbia River projects could result in improved streamflow and survival of petitioned stocks at and between Corps dams on the Columbia River below the mouth of the Snake River.

Importantly, existing flood control rule curves limit winter storage in Brownlee and Dworshak during average and above-average water years. This could substantially affect the amount of water potentially available to enhance juvenile migrant flows via changes in hydropower operations. Therefore, flood control and hydropower operations must be considered together at these projects, as well as the interaction of these projects with flood control and power operations at other projects in the Columbia River Basin.

B. *Modify flood conrol rule curves*

Most major Snake River Basin storage reservoirs include flood control in their operations. Palisades and Jackson provide flood protection for agricultural lands in the Idaho Falls area. Lucky Peak, Arrowrock and Anderson Ranch protect the lower Boise River Valley, Cascade and Deadwood reservoirs the lower Payette River Valley, Brownlee and Dworshak reservoirs provide flood protection to Lewiston and Portland/Vancouver.

Modifying Brownlee and Dworshak flood control rule curves may help enhance lower

Snake River flows during the juvenile salmon and steelhead migration period.

Modifying flood control rule curves basically would involve reducing the amount of storage space required for a given runoff forecast or delaying evacuation of space to take advantage of greater accuracy in runoff forecast. The increased risk of spill and downstream flooding would be avoided by shifting flood control responsibility to Columbia River projects.

Brownlee and Dworshak Reservoirs' flood control responsibility to Lewiston might be significantly reduced by drawing down the pool behind Lower Granite Dam (see Action 1). Additional levee work might be necessary to reduce flooding risk. These projects' relatively small flood control responsibility to Portland/Vancouver (about 7 percent in extreme flood conditions, virtually none in dry years) should be shifted to Columbia River storage projects.

To assure benefit to fish, reservoirs should be at or near revised elevations at the time water budget requests are made. Brownlee and Dworshak need to be full by July 1 each year to meet multiple use objectives. This need, plus imperfect runoff forecasting, must be considered in quantifying the potential yield from modifying flood control rule curves. System analysis is required to quantify the interactition and potential water yield of modifying hydropower and flood control rule curves.

Modification of flood control rule curves will not automatically make more water available for fish flow enhancement. Water rights for Bureau of Reclamation and Idaho Power projects would have to be modified to effect a change in flows.

*C. Obtain uncontracted, uncommitted, and contracted storage space for fish*

--*Use the 4.5 million acre feet of non-treaty storage to enhance instream flow/juvenile survival.*

Bonneville Power Administration recently contracted for 4.5 million acre feet of non-treaty storage in Columbia River reservoirs in Canada; 2.5 MAF is storage not previously under contract and therefore, less committed or constrained by traditional use.

This storage space should be dedicated to enhancing mainstem flows/juvenile survival. The petitioned Snake River salmon stocks can be benefitted by direct enhancement of Columbia River flows below the mouth of the Snake River and by displacing winter power generation at Brownlee and Dworshak (see Action A).

*--Evaluate use of uncontracted space in Lake Roosevelt to enhance lower Columbia River streamflows/Snake River juvenile fish survival, and to improve lower Snake River flows by displacing power generation at Brownlee and Dworshak Reservoirs.*

*--Evaluate limited use of uncontracted space in Bureau of Reclamation reservoirs above Brownlee Reservoir.*

Uncontracted space in Bureau of Reclamation reservoirs exists upstream of Brownlee Dam. However, the bulk of this space is committed to a variety of uses, including hydropower production, minimum pool maintenance for recreation and resident fish and wildlife, settlement of tribal water claims, and irrigation. In one instance, the state of Idaho has been considering purchase of uncontracted storage in Cascade Reservoir in order to protect the water quality of one of Idaho's most popular resident fisheries. Possible refill problems may also bedevil year-to-year use of some uncontracted space. Nonetheless, some of this uncontracted but otherwise committed space might be made available on an interim basis to augment lower Snake River stream-flows, directly or through water/energy exchanges. This should be considered an interim measure and would require modifycation of Bureau of Reclamation water rights.

*-- Lease or purchase from willing sellers contracted space in reservoirs above Brownlee Reservoir.*

Lease or purchase of contracted space from willing space holders has potential to increase lower Snake River flows/juvenile survival rates. Contracted storage space is annually available through water banks. The State of Idaho supports a three-year pilot study of renting water to determine if water can be delivered to Lower Granite and help fish. There are also significant institutional impedements to using water bank water to enhance lower Snake River flows. Competition from other water users, lack of dry-year availability, transportation difficulties and distance of many storage reservoirs also complicate but do not obviate the potential for enhancing lower Snake River flows through creative lease or purchase of contracted storage space.

## Long-term Recovery Actions

*1] Permanent modification of system operations of the federal dams on the Columbia and lower Snake rivers is critical to a sustained recovery of Snake River stocks. Therefore, a hard constraint must be placed on operating the federal dams to increase the juvenile fish survival rate.*

2] *Establish independent panel of experts to evaluate system operations and design features on the main-stem hydroelectric projects to pass juvenile fish as originally intended.*

Contrary to long standing public policy, the Army Corps of Engineers' main-stem dams were not designed to pass juvenile migrant salmon and steelhead. Design of bypass and collection facilities retrofitted to date was driven by hydropower operations. It is time to take a fresh, independent look at the basic design of these projects with juvenile fish passage as the objective.

The dams and operational modes should be modified as necessary to provide juvenile fish passage that will ensure the survival and long-term productivity of the petitioned Snake River salmon runs.

3] *Construct new storage in Snake River Basin above Brownlee Reservoir as necessary to supplement juvenile survival improvements resulting from Near-term Recovery Actions and redesigning main-stem dams. Dedicate new storage to fish by statute.*

Numerous potential sites for new storage have been identified in the Snake River Basin above Lower Granite Dam, including pumped storage projects. For example, the Army Corps of Engineers investigated the feasibility of a dam and reservoir at the Galloway site on the Weiser River. This project has approximately 750,000 acre feet of active storage. Cost is estimated at approximately $127 million, the equivalent of less than three years of ratepayer investment in the Columbia River Basin Fish and Wildlife Program at fiscal year 1991 levels. Of course all new storage sites entail some costs to the areas that would be affected. A railroad line would likely be relocated if Galloway were built.

4] *Investigate creative NW-SW energy exchanges to facilitate and improve main-stem flows/ juvenile survival.*

Enormous amounts of energy are exchanged between the Northwest and Southwest. These energy exhanges are expressly designed to meet load and enhance revenues. To date, the system flexibility inherent in these exchanges has not been reviewed for its potential to faciliate changes in system operations that would enhance main-stem flows and survival of Snake River salmon stocks.

5] *Investigate potential water yields to enhance main-stem flows/juvenile fish survival by financing irrigation efficiency improvements in the Snake River Basin above Brownlee Reservoir.*

Approximately 16 MAF of water are diverted for irrigation in the Snake River Basin above

***"Contrary to long standing public policy, the Army Corps of Engineers' main-stem dams were not designed to pass juvenile migrant salmon and steelhead."***

Lower Granite Dam, uppermost of the four-dam complex on the lower main-stem Snake River. Approximately 6 MAF are consumptively used for irrigation. There is significant potential for improving irrigation efficiency.

Due to the complex interrelationship of irrigation efficiency, groundwater recharge, return flows, and existing water rights, the potential to enhance lower Snake River flows is fraught with unknowns and formidable institutional impediments. Disposition of any water "saved" would be directed by provision of state water law. Nonetheless, due to the large amounts of water involved, clearly there is some potential.

6] *Investigate the potential for facilitating improved main-stem flows by fuel-switching.*

Much of the present juvenile survival problem at main-stem dams flows from hydropower operations to meet winter loads. There appears to be significant potential for economically ameliorating this conflict over the long term by fuel switching, e.g., from electricity to natural gas for space heating.

7] *Investigate the potential for facilitating improved main-stem flows/juvenile fish survival through energy demand management and creative marketing strategies.*

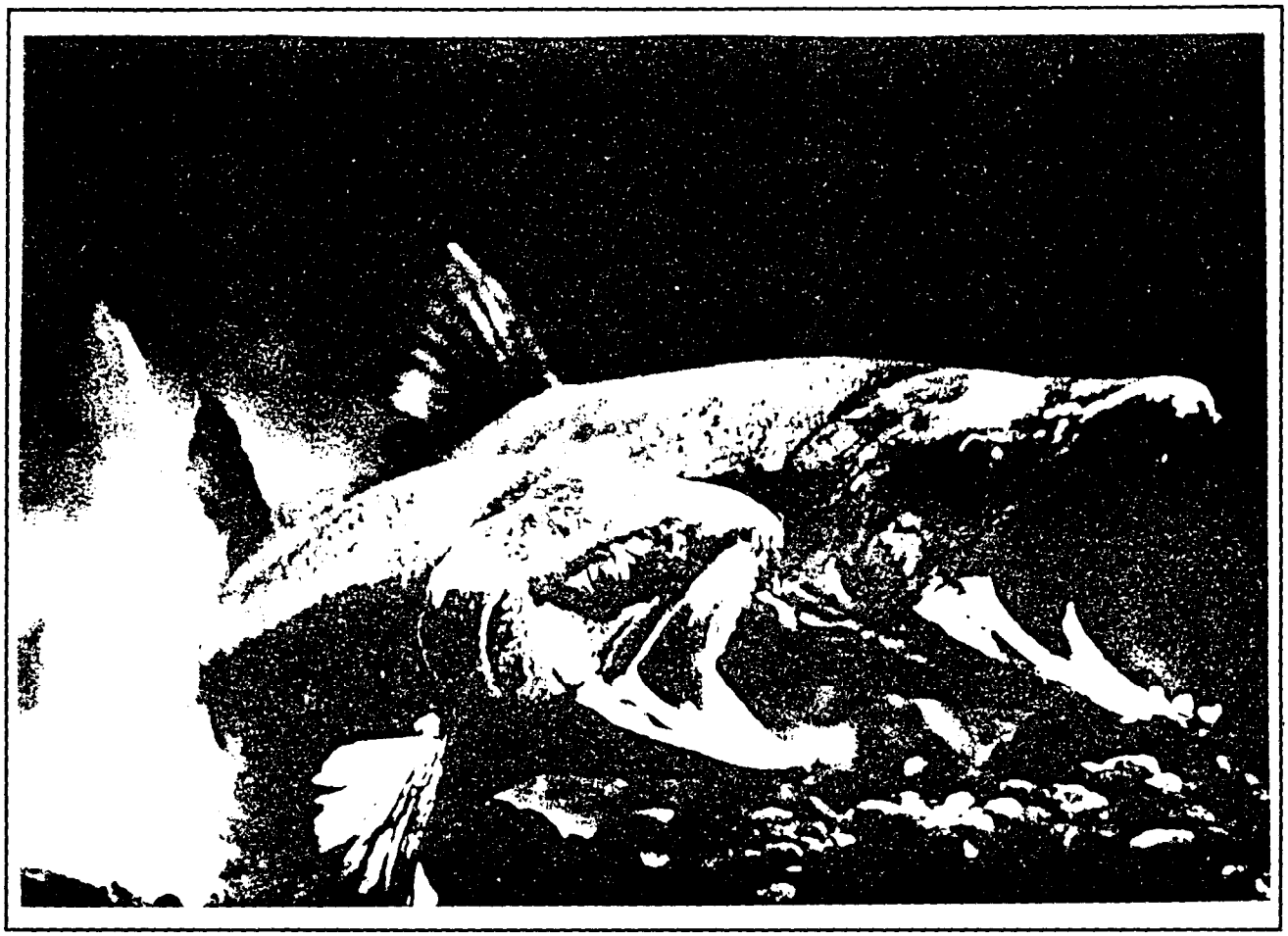
## Conclusion

Collectively these near- and long-term recovery actions can improve juvenile fish survival at main-stem dams to levels that will restore and sustain the petitioned Snake River salmon stocks at productive levels. These actions also will benefit all other salmon and steelhead stocks originating above Bonneville Dam and potentially avert petitions to list other stocks under the Endangered Species Act.

The Northwest Power Act requires protection, mitigation and enhancement of Snake River fish runs while maintaining an economical and reliable power supply. These are achievable objectives. Achieving this objective for the fish now requires financial resources that would not have been necessary if adequate measures for fish protection and enhancement had been implemented in the past. The commitment of these financial resources is unavoidable if the region is to enjoy the benefit of a salmon fishery along with hydroelectric production.

Over time, these short-term costs can be absorbed by the region as system operations provide both fish and energy. The net result of both energy and fish runs will be a dramatic increase in long-term regional economic diversification, productivity and quality of life.

# PRODUCTION



## Natural Production

### Chinook Salmon

IDAHO'S CHINOOK SALMON runs are classified as either wild or natural by the Idaho Department of Fish and Game (Table 2). Wild fish comprise native populations whose original characters have not been significantly altered by the outplanting of hatchery or non-native fish. The fish reproduce and sustain themselves under natural conditions. Natural fish reproduce and sustain themselves under natural conditions. Natural fish, however, are either not of native broodstock, or are native fish that have interbred with non-native fish as a result of hatchery fish outplanting into the native population or because of significant straying of hatchery fish into the native population.

Idaho has over 4,000 miles of spawning and rearing habitat for spring, summer and fall chinook. About 9 percent of that habitat is rated as excellent, 35 percent is rated as good, 44 percent is rated as fair, and 13 percent is rated as poor. Most of the habitat

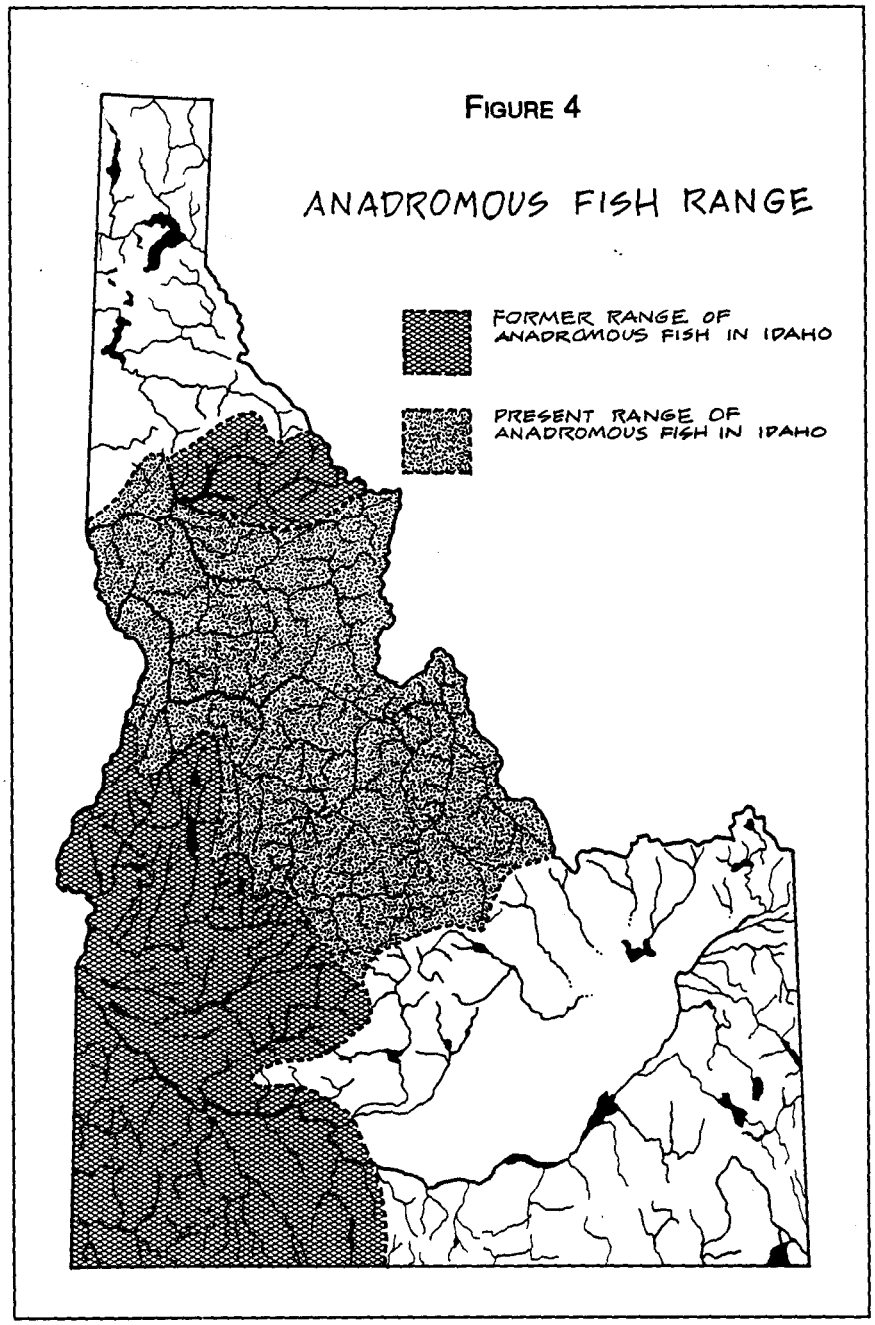
**TABLE 2. SPRING AND SUMMER CHINOOK SALMON PRODUCTION CLASSIFICATION FOR THE SALMON AND CLEARWATER SUB-BASINS.**

Wild Production

| Drainage | Race |
|---|---|
| Lower Salmon | Spring |
| Salmon Canyon tribs. | Spring |
| Secesh | Summer |
| Middle Fk. Salmon | Spring |
| Middle Fk. Salmon | Summer |
| Upper Salmon | Summer |

Natural Production

| Drainage | Race |
|---|---|
| Little Salmon | Spring |
| Little Salmon | Summer |
| S. Fk. Salmon (excludes Secesh) | Summer |
| Lemhi | Spring |
| Pahsimeroi | Summer |
| Upper Salmon | Spring |
| Headwaters | Spring |
| Lower Clearwater | Spring |
| M. Fk. Clearwater | Spring |
| S. Fk. Clearwater | Spring |
| Lochsa | Spring |
| Selway | Spring |




in the fair to poor classes is not rated as such because of habitat degradation, but because the natural features of the habitat (primarily gradient) are not suitable for chinook salmon, but are more suited to steelhead production.

Over 1,000 miles of production area remain for wild spring and summer chinook within the state, of which 53 percent is considered good or excellent quality. Vast areas of habitat are protected by Idaho wilderness designation. Additional large areas, such as the Sawtooth National Recreation area and South Fork Salmon River (SFSR) drainage in the Boise and Payette national forests, have anadromous fish habitat protection as top land use and water quality priorities. There are, of course, localized areas of severely degraded habitat such as portions of the SFSR and Panther Creek, both tributaries of the Salmon River.

Total production potential of the Idaho and Snake river chinook salmon habitat was estimated in the Columbia Basin systems and sub-basin

**TABLE 3. ESTIMATED CHINOOK SALMON SMOLT PRODUCTION POTENTIAL OF IDAHO'S STREAMS.**

| Race | Types | Millions |
|---|---|---|
| Spring chinook | Wild | **4.51** |
| | Natural | 7.90 |
| | Total | 12.41 |
| Summer chinook | Wild | **2.24** |
| | Natural | **1.66** |
| | Total | **3.90** |
| Fall chinook | Wild | **5.21** |
| | Natural | 0.37 |
| | Total | **5.58** |
| All chinook | Wild | 11.96 |
| | Natural | **9.93** |
| | Total | **21.89** |

planning process[1] to be almost 22 million smolts. This includes 6.75 million wild and 9.56 million natural spring and summer chinook (Table 3). While an enormous potential for natural smolt production of chinook exists, the potential is not being met. The Idaho Department of Fish and Game monitors annual juvenile abundance by snorkel counts of chinook parr in wild and natural spring and summer chinook production areas. The observed numbers are reported as a percent of the potential carrying capacity estimated for the monitoring site. The average counts from 1985-1988 for the program are provided inTable 4. Wild juvenile chinook production was only 1 to 31 percent of potential. Natural juvenile chinook production was only 2 to 40 percent of potential. Regardless of habitat quality, juvenile abundance is far below the potential production capacity. Abundance of naturally reproducing spring and summer chinook is monitored annually by counts of egg deposition sites (redds) formed by spawning salmon. The average redd counts for wild salmon during the 1985-89 period is approximately 25 percent of the average of counts prior to 1970. Redd counts for natural salmon were 19 percent of the pre-1970 average (Figure 5). These low redd counts occurred despite drastic post-1970 reductions in harvest.

**TABLE 4. MEAN PERCENT CARRYING CAPACITIES IN IDFG MONITORING SECTIONS FOR CHINOOK PARR FROM 1985 THROUGH 1988. (SCULLY ET AL., 1990).**

| Location/Description | ?ypg | $aca | Percent of carrying capacity |
|---|---|---|---|
| Middle Fork Salmon tributaries (without Bear Valley Cr. drainages) | Wild | SP | 17 |
| Lower reaches of Salmon R. Canyon tributaries | Wild | SP | 1 |
| Chamberlain Basin | Wild | SP | 31 |
| Bear Valley Creek (of Middle Fork Salmon River) | Wild | SP | 4 |
| All wild summer chinook areas (from Mid. FK, Secesh, and upper main Salmon) | Wild | SU | 11 |
| Upper Salmon River and E. Fk. Salmon | Natural | SP | 12 |
| Little Salmon River | Natural | SP | 13 |
| Selway River | Natural | SP | 2 |
| Lochsa River | Natural | SP | 3 |
| South Fk. Clearwater | Natural | SP | 40 |
| Lolo Creek | Natural | SP | 25 |
| Lemhi, N. Fk. Salmon and Panther Cr. | Natural | SP | 7 |
| South Fork Salmon River (exduding Secesh) | Natural | SU | 24 |

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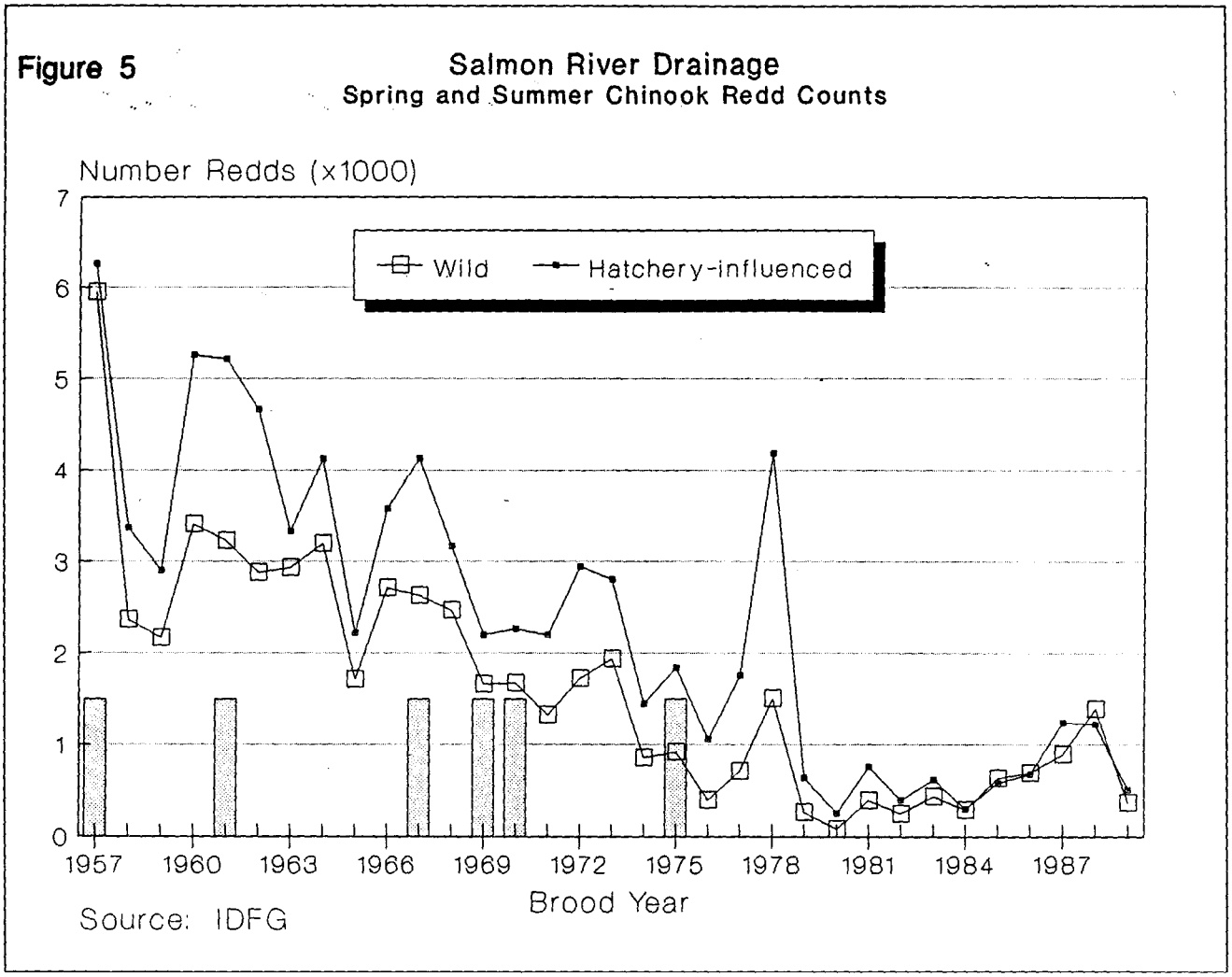
[1] Integrated System Plan for Salmon and Steelhead Production in the Columbia River Basin, Columbia Basin Fish and Wildlife Authority, August 1, 1990.




**Bonneville - 1938**
**McNary - 1953**
**The Dalles - 1957**
**Ice Harbor - 1961**
**John Day - 1967**
**Lower Monumental - 1969**
**Little Goose - 1970**
**Lower Granite -1975**

Sockeye Salmon

Stanley Basin sockeye salmon historically were produced in four major lakes. Sockeye spawn in inlet streams and lake shoreline shoals. Juvenile fish rear in the lakes to a size conducive for smolting. At present, only Redfish Lake is accessible for sockeye natural production. Habitat is ample for production at a much higher level than that currently occurring. Lack of returning adults is the limiting factor on production.

Alturas Lake (Figure 6) can quickly be made accessible to sockeye by implementing the recently completed Busterback Ranch upper Salmon River restoration plan. Spawning and rearing habitats of the lake are in good condition. The limiting factor is an irrigation diversion below Alturas Lake which diverts smolts into fields and de-waters Alturas Lake Creek during adult migration **periods.**

**Summary**

Neither the depressed populations nor the recovery of Snake River salmon result from the quantity or quality of natural production habitats.

Chronic high mortalities of juvenile fish at main-stem Columbia and Snake River dams result in insufficient adult fish to utilize the available habitat. Meanwhile, vast areas of potentially productive habitat are available. Most of the area is public land managed by the Forest Service and Bureau of Land Management. A significant percentage is legally protected wilderness and wild and scenic rivers.

This does not mean that protection of habitat should be ignored. Land management activities must be conducted in a way to minimize or avoid water quality impacts. Idaho's innovative water quality program, the product of a consensus agreement of timber, mining, agricultural, tribal, conservation and sportsmen interests must continue to be aggressively enforced by federal and state agencies. Review of the agreement in 1991 may provide the opportunity for fine-tuning to ensure protection of petitioned stocks.

Juvenile production is well below potential in all habitats, from poor to excellent condition. High mortality of existing natural production is limiting adult returns from that production. Habitat improvement actions to increase production will not contribute appreciably to increasing adult run sizes as long as excessive mortality continues at the eight Army Corps of Engineers main-stem dams on the lower Snake and Columbia Rivers.

## Near-term Recovery Actions

*1] Establish as hard constraint on operation of federal main-stem projects a juvenile survival rate for natural and wild fish that will allow populations to rebuild and utilize the existing habitat for increased production.*

*2] Implement Main-stem Passage Near-term Recovery Actions.*

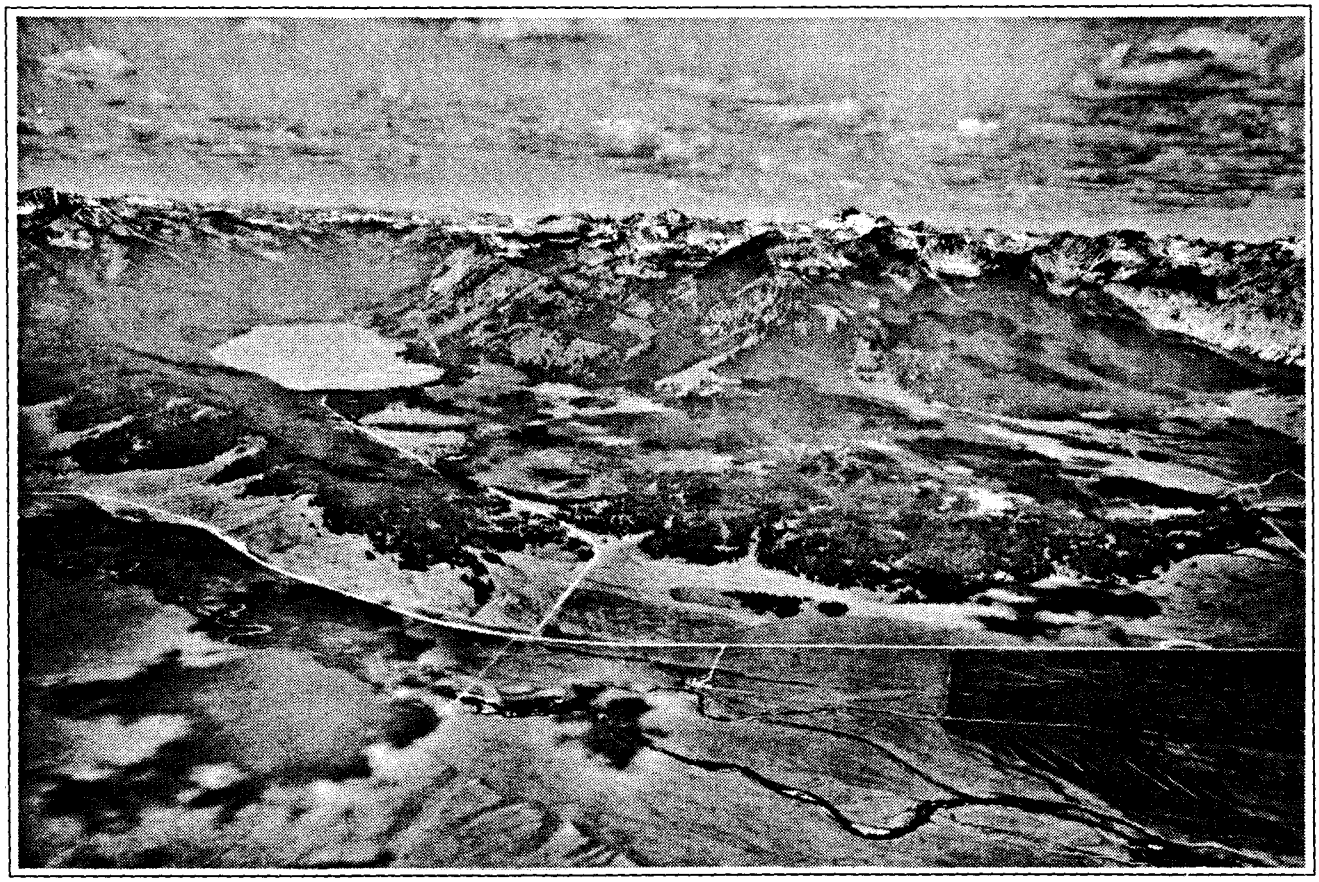


**Figure 6 Alturas Lake once produced sockeye in such abundance they were used to feed early mining communities.**

*3] Implement the Busterback Ranch upper Salmon River recovery plan to improve in-stream flows to access Alturas Lake and improve spring chinook, sockeye and steelhead migration, spawning and rearing.*

*4] Identify other instances of needed instream flow to provide access to spawning and rearing areas.*

*5] Increase funding to complete irrigation ditch screening in the Salmon, Clearwater and lower Snake sub-basins to prevent migrating juveniles from being diverted from tributary streams into canals.*

*6] Develop and implement lake fertilization of Redfish Lake and Alturas Lake to increase sockeye/kokanee production.*

*7] Support U.S. Forest Service efforts to restore South Fork Salmon River critical natural production habitat for summer chinook.*

*8] Complete clean-up of Blackbird Mine and restoration of Panther Creek fish habitat.*

### Long-term Recovery Actions

*1] Focus long-term habitat improvement investments on areas of critical habitat, with priority on genetic sanctuaries (see Action 4 under Hatchery Production).*

***"At [current] adult return rates ... Idaho hatchery production would have to be increased at least 400 percent to achieve the intended mitigation of 80,000 adult fish back to Idaho."***

### Hatchery Production

The Idaho hatchery program originated to partly mitigate for lost natural production areas (Idaho Power Company Snake River Hells Canyon hydroelectric complex, U.S. Army Corps of Engineers North Fork Clearwater River Dworshak Dam) and increased juvenile migration mortality at the four Corps dams on the mainstem Snake River.

The Idaho hatchery program is still expanding with Pahsimeroi and Clearwater hatcheries not yet at full production. At full production, *80,000* hatchery adult salmon were expected to return to Idaho, a surplus allowing for fisheries. Twelve thousand adult salmon are required to keep hatcheries at full seeding capability. With most hatcheries at full production, adult returns to Idaho hatcheries have averaged only 10,800 fish over the last five years (Table 5). This is only 90 percent of the number needed to perpetuate hatchery fish and only 13.5 percent of the anticipated adult return.

Adult return goals were based on anticipated smolt to adult return rates of *0.65-0.87* percent. Recent returns have declined to 0.2 percent or less for brood year *1984* and *1985* adult returns (Table *6).* Return rates are expected to decline further as the effects of the current drought on adult return rates become evident. At adult return rates of 0.2 percent (which are above those wit-

**TABLE 5. IDAHO SPRING AND SUMMER CHINOOK HATCHERIES PRODUCTION CAPACITIES AND AVERAGE ADULT RETURNS, 1986 TO 1990.**

| | Smolt program anticipated prod'n (million) | Adult Goal' | Brood ngg~ | Adult return 1986-1990 average. | Average adult (shortage) surplus |
|---|---|---|---|---|---|
| Spring Chinook | | | | | |
| Clearwater-LSRCP | 1.4 | 12200 | 1580 | **449** | (1131) |
| Dworshak-NF/LSRCP | 1.4 | 9135 | 1465 | 1637 | 216 |
| Kooskia-NF | **0.8** | 5200 | 690 | 734 | **44** |
| Rapid River-IPC | 3.0 | 19500 | 2921 | **3943** | 1022 |
| Sawtooth-LSRCP | 1.9 | 14030 | 1709 | 1741 | 32 |
| East Fork-LSRCP | 0.7 | 5170 | 629 | 347 | (282) |
| Total spring chinook | **9.2** | **65235** | **8994** | **8851** | (143) |
| Summer chinook | | | | | |
| McCall-LSRCP | 1.0 | 8000 | 1811 | 1572 | (239) |
| Pahsimeroi-IPC | 1.0 | 6500 | 1501 | 411 | (1090) |
| Total summer chinook | 2.0 | 14500 | 3312 | **1983** | (1329) |
| Total chinook | 11.2 | **79735** | 12306 | **10834** | (1472) |

**'Adult goals were not established for Kooskia, Rapid River, and Pahsimeroi. Return rate goals for Clearwater, Dworshak, Sawtooth, East Fork, and McCall are .65 to .87 percent, established in Lower Snake River Compensation Plan.**

nessed in 1989 and 1990), - Idaho hatchery production would have to be increased at least 400 percent to achieve the intended mitigation of 80,000 adult fish back to Idaho. The Nez Perce Tribe's proposed chinook hatchery offers potential benefits, but poor returns experienced at existing hatcheries suggest unsatisfactory returns might result there as well. Poor survival hinders enthusiasm for what could be a beneficial program for the Nez Perce Tribe and other people of Idaho.

Returns of adult fish to upper basins, particularly the Sawtooth (near Stanley) and the East Fork of the Salmon hatchery (near Pahsimeroi), are currently below replacement levels (less than 0.1 percent). Inadequate numbers of spawners are returning from smolt releases to maintain hatchery production. Without increased smolt-to-adult survival rates, the Sawtooth Hatchery run will become extinct.

Sustained salmon harvest cannot be provided for Idaho fishermen at adult return rates less that 0.2 percent. Consistent harvestable surpluses and rebuilding of natural stocks need to occur prior to providing sustained harvest opportunities for Idaho fishermen. This cannot occur until smolt-to-adult survival rates increase. This requires significant reduction in juvenile mortalities at main-stem dams and limits on mixed stock harvest rates in marine and Columbia River fisheries.

## Genetic Concerns

In recent years, genetic scientists have raised increasing concerns about preserving the genetic integrity of wild populations:

--It is unlikely that the long-term productivity of hatchery

**TABLE 6. PERCENT SURVIVAL OF SMOLTS REARED AND RELEASED AT VARIOUS IDAHO SALMON HATCHERIES, 1966-87, AND RETURNING AS ADULTS.**

| Release Year | Percent Survival By Hatchery | | | | | |
|---|---|---|---|---|---|---|
| | Dworshak | Kooskia | Rapid R. | Sawtooth | McCall | Pahsimeroi |
| **1966** | | | 0.79 | | | |
| 1967 | | | 0.88 | | | |
| **1968** | | | 0.48 | | | |
| **1969** | | | 0.60 | | | |
| 1970 | | | 0.53 | | | |
| 1971 | | | 0.56 | | | |
| 1972 | | | 0.08 | | | |
| 1973 | | | 0.20 | | | |
| 1974 | | | 0.24 | | | |
| 1975 | | | 0.32 | | | |
| 1976 | | | 0.20 | | | |
| 1977 | | | 0.02 | | | |
| 1978 | | 0.05 | 0.08 | | | |
| 1979 | | 0.10 | 0.14 | | | |
| **1980** | | 0.11 | 0.16 | 0.60 | | |
| **1981** | | 0.05 | 0.05 | 0.22 | | |
| 1982 | | 0.04 | 0.11 | 1.12 | | |
| 1983 | 0.07 | 0.39 | 0.28 | 1.09 | 1.10 | 1.04 |
| **1984** | 0.28 | **0.08** | 0.20 | 0.91 | 0.86 | 0.66 |
| 1985 | 0.26 | 0.27 | 0.17 | 0.43 | 0.80 | 0.54 |
| 1986 | 0.16 | 0.15 | 0.17 | 0.08 | 0.18 | 1.26 |
| 1987 | 0.10 | 0.12 | 0.08 | 0.04 | 0.10 | 0.14 |

stocks can be maintained as isolated interbreeding units.

--Genetic material from naturally spawning stocks is needed to maintain long-term productivity of hatchery stocks.

--Introduction of hatchery and non-native stocks into native natural stocks will reduce productivity of the natural stocks by genetic alteration.

--Preservation of genetic characteristics of all remaining endemic populations is critical to avoid irretrievable loss of genetic material.

--Supplementation is an unproven concept that must be carefully evaluated through experimental designs such as the Yakima Klickitat Project before it becomes an accepted management technique to safeguard against further genetic dilution. Most outplanting programs have not succeeded, especially when the intent was to boost natural production (Reisenbichler and McIntyre 1986; Miller et al. 1990).

-- Genetic concerns are especially important to Idaho because Snake River chinook are the most distant migrating stocks remaining in the Columbia Basin. Should they become extinct, suitable replacement stocks are not available.

Low smolt-to-adult survival rates have prevented hatcheries from meeting their goals and have prevented natural production from rebuilding. This creates a dilemma for long-term hatchery productivity. Without naturally spawning brood stock to mix into the hatchery population, hatchery stock productivity will likely decline and runs of hatchery fish will decline and collapse, as at some other hatcheries.

Hatchery production signifycantly complicates natural production management. Juvenile mortalities at federal main-stem dams have devastated wild populations. Hatchery fish

comprise the majority of the Snake River runs. The imbalance increases probabilities for straying of hatchery fish into natural populations, for hatchery/natural interbreeding, for genetic changes that reduce productivity of natural production, and for interbreeding of non-native hatchery fish with wild fish and consequent alteration of endemic genetic materials.

When returns of hatchery fish exceed hatchery capacities, discarding the excess eggs or fish is socially difficult. Using hatchery surpluses to seed natural production areas usually results in reduced rather than increased production. Adverse genetic changes in populations are likely to result.

## Summary

Further hatchery production is not a solution to declining Snake River stocks. Low smolt-to-adult survival has prevented existing hatcheries from meeting program goals. Even with increased hatchery production, poor survival has precluded significant fisheries. Poor survival precludes construction of additional new hatcheries in the short term.

For the long-term preservation of productive hatchery stocks, juvenile survival rates must be improved and wild and natural stocks rebuilt. Natural stock rebuilding is critical to correct the imbalance of hatchery fish in fish runs in order to avoid genetic deterioration of natural fish. Sustained low survival rates place all Snake River production at severe risk.

## Near-term Recovery Actions

*1] Establish as hard constraint on operation of federal mainstem projects a juvenile survival rate that will allow hatchery production to achieve mitigation objectives in parallel with improved natural productivity.*

*2] Construct smolt acclimation ponds at the East Fork Salmon River and South Fork Salmon River to reinforce hatchery fish homing and minimize straying and interbreeding with natural or wild populations.*

*3]Critically evaluate existing hatchery operations/supplementation programs to minimize interbreeding of hatchery and natural fish with wild fish.*

*4]Establish genetic sanctuaryies.*

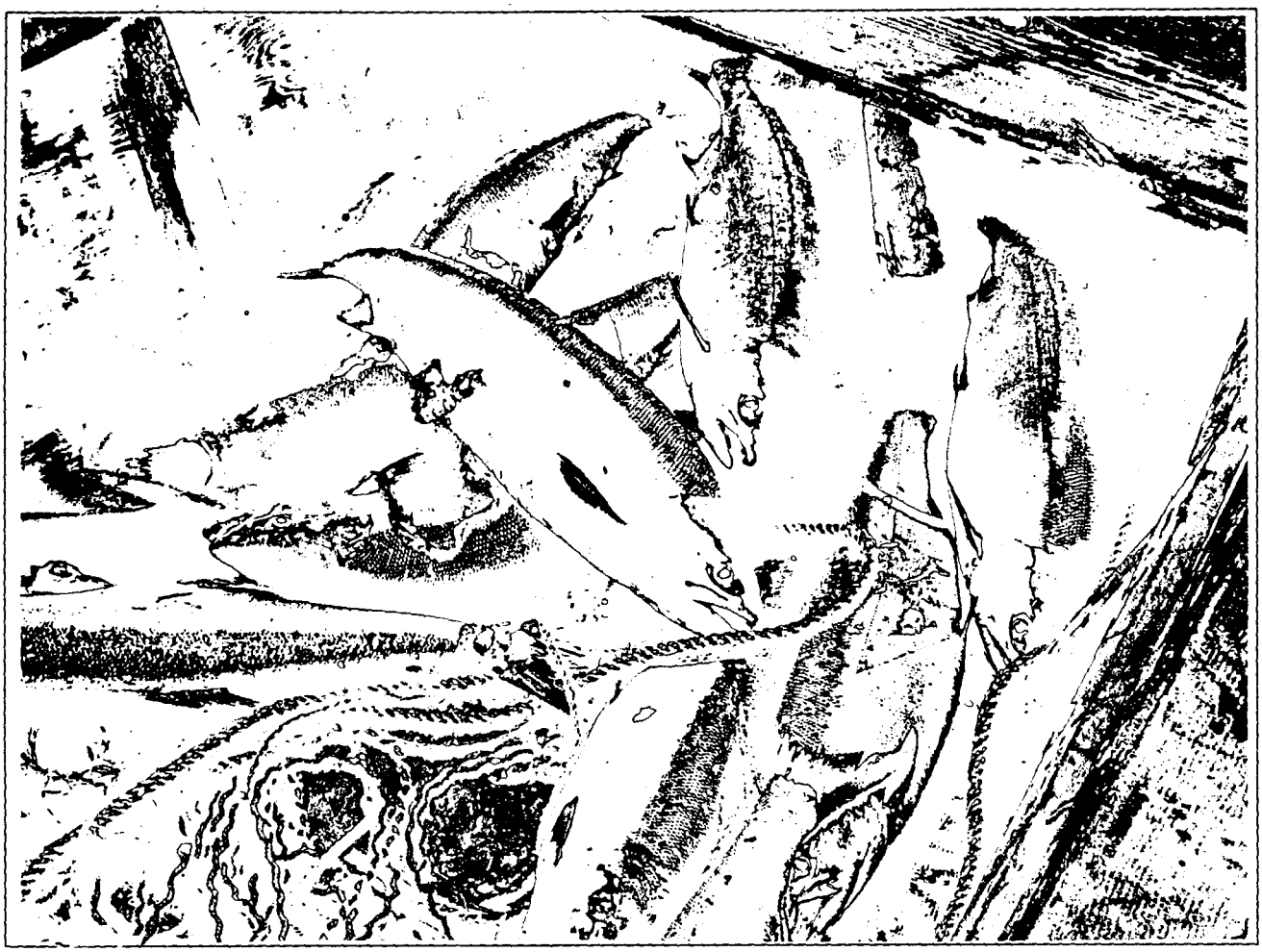
## Long-term Recovery Actions

1] *Intensify research aimed at reducing early migration mortality of hatchery smolts.*

*2] Develop improved techniques for positive identification of hatchery- and naturally produced fish for harvest management and genetics management.*

***" Inadequate numbers of spawners are returning from smolt releases to maintain hatchery production. Without increased smolt-to-adult survival rates, the Sawtooth Hatchery run will become extinct."***

# HARVEST



ARCHAEOLOGICAL EVIDENCE SUGGESTS that for more than 10,000 years Snake River anadromous fish contributed to fisheries nearly 1,000 miles inland and for thousands of miles along the Pacific coast.

Prior to 1965, Idaho chinook salmon fisheries were directed at wild fish returning to spawning tributaries. Early tribal fisheries harvested fish over a wide geographic area for thousands of years. Later, Idaho sport fisheries harvested 12,000-39,000 fish annually.

Stock declines in the mid-1960s were accompanied by reduced fisheries and the first closed sport season in 1965. By 1979 wild chinook numbers had declined to the point where sport fisheries were no longer possible. The only non-tribal chinook fisheries since 1979 have been directed at hatchery stocks. An experimental North Fork and mainstem Clearwater River fishery for Dworshak National Fish Hatchery spring chinook salmon was conducted in 1990. The fishery was operated with mandatory catch accounting at Department of Fish and Game check stations to

assess incidental impacts to naturally produced chinook.

Tribal fisheries in Idaho also were reduced as numbers of salmon declined. Contemporary tribal fisheries target hatchery and natural chinook. Hatchery steelhead provide the only significant anadromous sport fishery in Idaho. Wild steelhead are protected with catch-and-release regulations because of low abundance. Their population trends have followed closely those of chinook salmon.

## Regional Fisheries

Idaho salmon and steelhead are caught in Pacific Ocean and Columbia River fisheries (Table 7). Impacts of these fisheries vary and often are not clearly determined. Recent monitoring of some ocean fisheries that historically catch Snake River fish has not en-countered these fish. It is unclear whether Snake River fish are no longer caught or whether they are undetected because of low abundance relative to monitoring intensity. The latter is most likely. Most fisheries are regulated by formal processes to achieve specific harvest objectives. Processes include the Pacific Salmon Treaty, the Pacific Fishery Management Council, Columbia River Fish Management Plan and Columbia River Compact. Allocation agreements between fisheries agencies, tribes and other users drive the fishery regulation process.

## Mixed Stock Harvests

In the ocean and main-stem Columbia River, Idaho salmon and steelhead intermingle with fish produced in many other areas. Most fisheries impact Snake River salmon stocks.

The risk for over-fishing Snake River stocks is great. The poor productivity of Snake River stocks because of high juvenile migration mortality limits to very low numbers the allow-able losses of fish to other causes, such as fisheries. The probability of over-harvest is increased by Snake River fish being intermingled with pro-ductive groups of fish in the same fishing areas. Given the traditional emphasis on mixed stock as opposed to known stock harvest, harvesting large numbers of fish from the pro-ductive stocks either over-fishes the less productive, weak Snake River stocks or under-fishes the productive, strong stocks. This is the mixed stock fishery dilemma.

Unproductive stock conditions provide little harvest opportu-nity and promote a high risk of over-harvest. High risk re-quires conservative fishery management programs to avoid over-fishing. In the absence of known stock fisheries, conser-vative fishing may lead to "under-fishing, " i.e., catching less than 100 percent of the al-lowable harvest of productive stocks.

**TABLE 7. FISHERIES OCCURRENCES OF IDAHO SALMON AND STEELHEAD AS INDICATED BY CODED WIRE TAG RECOVERIES AND GENETIC STOCK IDENTIFICATION .**

| | Species Occurrence | | | |
|---|---|---|---|---|
| Fishery | Spring | Summer | Fall | Other |
| SE Alaska | | | | |
| Troll | | | X | |
| Net | | | X | SH-WA |
| Sport | | | X | |
| British Columbia | | | | |
| N.Coast Net | X | X | | SH-WA,WB |
| N.Coast Troll | | | X | SH-WB |
| Johnstone St.Net | | | X | SH-WA |
| Juan de Fuca St. | | | X | |
| W.Coast Vanc. Is. | | X | X | SH-WA,WB |
| Georgia St.Sport | | | X | |
| Washington | | | | |
| Juan de Fuca St.Net | | | | SH-WA |
| Juan de Fuca St.Spt | | | X | SH-WA |
| Puget Sound Spt. | | X | | SH-WA |
| Puget Sd.Treaty Net | | | X | |
| Coastal Sport | | X | X | SH-WB |
| Ocean Treaty Troll | | | X | |
| Coastal Troll | | | X | |
| Coastal Net | | | | SH-WB |
| Oregon | | | | |
| N.Coast Troll | | X | X | |
| C.Coast Troll | | | X | SH-WA |
| C.Coast Sport | | | X | |
| California | | | | |
| Ocean Troll | | | X | |
| Ocean Sport | | | X | |
| Columbia River | | | | |
| Nontreaty Net | X | X | X | SH-WA,WB,SE |
| Sport | | X | X | |
| Treaty Net | X | X | X | SH-WA,WB,SE |
| High Seas Gillnet | | | | SH-WA |

SH-WA: Wild A-run steelhead
SH-WB: Wild b-run steelhead
SE: Sockeye salmon

Source: Idaho Department of Fish andGame

Under-fishing is regarded by many to be economically wasteful. To avoid shifting from mixed stock to known stock fisheries, justifications for over-fishing weak stocks become increasingly innovative. The unfortunate, inevitable results are reduced long-term harvests and high risk of extinction for weak stocks.

## Institutional Impediments To Recovery of Snake River Stocks

The present harvest regulatory structure is not adequate to prevent extinction of the petitioned Snake River stocks.

More than a dozen governmental agencies assert some jurisdiction over the harvest of Snake River anadromous fish runs. Although there have been limited attempts to coordinate harvest, the coordination has been for the purpose of ensuring greater harvest for the coordinating parties rather than for ensuring an adequate escapement for these depressed runs. For example, the Columbia River Fish Management Plan (CRFMP) that grew out of U.S. vs. Oregon, is designed primarily for the allocation of the mixed anadromous fish runs in the Columbia River. Although the plan purports to establish harvest limits on spring and summer chinook runs, the plan uses management goals which focus on harvest, rather than escapement goals necessary to preserve the runs. Further, the plan does not address tributary harvests but instead leaves this important issue to sub-basin management plans. Parties to the CRFMP have made no significant progress toward accounting for the impacts of tributary harvests.

The CRFMP provides for harvest on some under-escaped runs regardless of run size. While harvest rates are modest for some under-escaped runs (12 percent maximum on upriver spring chinook) others are excessive (32 percent maximum on wild B-run steelhead) regardless of how badly under-escaped. So long as status quo harvest management continues; there is not an effective means for ensuring adequate escapement levels for the petitioned Idaho runs. Indeed, attempts by the individual parties to maximize their harvest opportunities will force the Snake River runs into extinction.

## Summary

Any recovery plan for the Snake River anadromous fish runs must take into account harvest impacts. Otherwise, gains made in improved juvenile survival at main-stem dams and in natural production will be lost.

Chronic high juvenile mortalities at federal main-stem dams have reduced wild and natural Snake River salmon stocks far below fishable levels throughout their range. In Idaho, even hatchery stocks are not fishable except occasionally in limited terminal areas.

***"Long experience has demonstrated, and it is generally conceded, that the fishery for any species must be regulated by a single authority throughout its entire range if the supply is to be conserved. This is particularly true of anadromous species, such as the salmon, that are especially vulnerable to overfishing. No such single authority exists for the fisheries of the Columbia River, hence one should be established."***

--1937 Report of the Commissioner of Fisheries to the U.S. Senate Committee on Commerce

***"...Consolidate the presently fragmented support of amidromous fisheries into one Federal/State/Indian council with planning and policymaking responsibilities for fisheries restoration and for coordination of all aspects of fishery resource management from hatchery operations and migration assistance through commercial and sport harvesting in fresh and salt water."***

*--1979* General Accounting Office report to Congress on then-pending Pacific Northwest Electric Power Planning and Conservation Act of 1980

Harvest rates on petitioned stocks have been sharply reduced; in Idaho harvest has, for all practical purposes, long been eliminated.

Additional harvest restrictions in marine and Columbia River mixed stock fisheries will provide necessary short-term relief to some stocks. However, significant, long-term improvements in productivity will require significant improvements in juvenile survival at and between main-stem dams coupled with long-term limits on mixed stock harvest rates.

## Near-term Recovery Actions

*1]Establish for all petitioned stocks escapement levels that are hard constraints on harvest.*
Once established, these hard constraints must be respected by every entity regulating harvest. Only through this approach will there be any assurance that the runs will be protected. An additional benefit of using escapement levels as hard constraints is that it will force all harvesting regulators, both ocean and in-river, to coordinate their harvests. Such coordination is long overdue.

*2]Establish independent panel of experts to evaluate known stock gear for main-stem Columbia River fisheries.*

*3] Identify opportunities for shifting some main-stem Columbia River harvest to tributaries pending recovery of petitioned wild stocks.*

*4]Establish more intensive ocean and Columbia River monitoring to identify weak stocks and allow targeting strong stocks. Weak stocks such as Snake River spring and summer chinook should be adequately protected upon entering the Columbia River.*

*5]As in interim measure pending recovery of Snake River stocks, transfer a significant portion of treaty commercial fishery on fall chinook to below Bonneville Dam to reduce impact on wild A- and B-run steelhead which have declined precipitously in recent years. This action might avert petitions for listing these stocks under the Endangered Species Act.*

The present harvest scheme forces treaty fishers to fish for fall chinook above Bonneville Dam in late August and September, when the fall chinook are intermixed with wild A-run and wild B-run steelhead, two runs that have suffered serious declines in recent years.

If treaty fishers were allowed to fish for fall chinook below Bonneville Dam in August, before many steelhead are intermixed with the chinook, treaty fishers could achieve

nearly their full allocation of fall chinook with minimal impact on wild A-run and B-run steelhead. Any shortfall in the treaty allocation could be fulfilled by scheduling a brief treaty fishery above Bonneville Dam in September.

This action must fully recognize treaty-fishers' rights and interests.

## Long-term Recovery Actions

*1] Develop improved techniques for identifying Snake River salmon and steelhead stocks in mixed stock runs and fisheries.*

*2] Conduct stock migration research to identify behavorial patterns of petitioned stocks and allow shaping fisheries to optimize escapement.*

*3] Replace the anachronistic Columbia River Compact with a regional harvest coordination entity which provides all producing and regulatory jurisdictions with equitable representation. Adopt equitable allocation principles.*

Some discussion has resurfaced on putting Idaho in the Columbia River Compact. In 1975 Idaho sued to join, but the courts determined only Congress could act to include Idaho. Adding Idaho to the Compact, although a significant improvement in the existing regulatory scheme, is no panacea because the Columbia River Compact no longer serves a useful purpose. The power of the compact has been eviscerated by the CRFMP. Since Washington and Oregon are parties to the CRFMP, action of the Compact is effectively controlled by the CRFMP. Thus, for all practical purposes the Compact is severely limited in the action it may take to protect the runs. Further, because not all affected parties are members of the Compact or signatories to the CRFMP, the Compact provides a natural vehicle for advancement of the special interests of Compact members and the parties who drafted and signed the CRFMP.

It is a basic tenet of democracy and of modem fish management that producing jurisdictions have an equitable voice in management of harvest on fish produced in their respective jurisdictions.

There should be a harvest coordination group in which all regulating and producing entities are equitably represented.

Escapement goals and harvest coordination should be geared toward recovery of weak stocks by preventing over-harvest and providing for optimum natural production.