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IDAHO's ANADROMOUS FISH STOCKS:

Their Status and Recovery Options

Report to the Director
Idaho Department of Fish and Game
600 S. Walnut Boise, ID 83707

May 1, 1998
IDFG 98-13
Second Printing

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Philip E. Batt / Governor
Stephen P. Mealey / Director

June 8, 1998

Greetings:

I am pleased to provide the second printing of the Idaho Department of Fish and Game staff report *Idaho's Anadromous Fish Stocks: Their Status and Recovery Options.* The report was completed May 1, 1998, and provided the basis for the Idaho Fish and Game Commission Policy Statement *Limiting Factors and Recovery Options for Anadromous Fish Stocks in Idaho* adopted May 8, 1998.

The second printing of the Department staff report includes the original report with some useful additions. In addition to this cover memo, the second printing includes the Commission Policy Statement referenced above, a letter to Department staff by Commissioner Keith Carlson on behalf of the entire Commission, and a memo from me to Department employees on policy implementation. The end of the report includes a memorandum by Assistant Director Jerry Mallet describing a qualitative risk and uncertainty assessment of recovery options by Department staff. This additional assessment was completed at my request. The second printing also includes some minor editorial changes that were missed in the first printing. This includes clearer pagination and headings and some minor wording clarifications. These edits do not alter the original content or conclusions of the Department staff report.

As mandated in the Commission Policy Statement, I encourage you to carefully consider the information provided in this report and welcome your comments and critiques. Please send them to Ms. Margaret Whipple, Fisheries Bureau, Idaho Department of Fish and Game, P.O. Box 25, Boise, ID 83707 or E-mail mwhipple@idfg.state.id.us.

Best Regards,

Stephen P. Mealey

Stephen P. Mealey,
Director

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IDAHO FISH AND GAME COMMISSION

600 South Walnut • Box 25 • Boise, Idaho 83707-0025 208-334-3700

May 18, 1998

Steve Mealey
Director
Idaho Department of Fish and Game
600 South Walnut
Boise, ID 83707

Dear Steve:

On behalf of the entire Commission, I want to express our appreciation for the work that went into the preparation of *Idaho's Anadromous Fish Stocks - Their Status and Recovery Options.* At the Lewiston meeting, the Commission unanimously adopted the findings of this report and the Commission Policy Statement, *Limiting Factors and Recovery Options for Anadromous Fish Stocks.* We did so with the understanding that there will be some refinements to the analysis of the options and public review of the documents.

Without your leadership and that of Assistant Director Jerry Mallet and the efforts of the Fisheries staff, we could not have taken this action. The preparation of this report required long hours, hard work, and the professionalism that we sometimes take for granted.

Any effort of this magnitude and short deadlines is likely to produce disagreements and strife during the process; this was no exception. We all recognize that the ultimate goal is saving our fish. There was never a question of what we were going to do; the science is clear. That there were differences about when the Commission should act on both causes for salmon decline and options for recovery and in what format, is understandable given the complexity of the information.

As the discussion proceeds toward the 1999 decision point, you can anticipate that the scientific findings will be questioned and pressure will be exerted to influence the Department and Commission. I know we will all continue to resist these pressures while remaining open to legitimate scientific peer review.

Please disseminate this letter to the entire Department with our sincere appreciation for a "job well done."

Sincerely,

Keith E. Carlson
Commissioner
Clearwater Region

LIMITING FACTORS AND RECOVERY OPTIONS FOR ANADROMOUS FISH STOCKS IN IDAHO

Idaho Fish and Game Commission Policy Statement
May 8, 1998

In accordance with Idaho Code 36-104, the Commission has reviewed available information concerning the State of Idaho's anadromous fish' and found that the mainstem dam and reservoir system in the lower Snake and Columbia rivers is the primary factor limiting recovery of Idaho's wild salmon and steelhead. The smolt transportation program has not compensated for this limiting factor to date.

At this time, based on available information, the Commission considers the "natural river option[*2] to be the best biological choice among 1999 Decision Point options for recovery of Idaho's wild salmon and steelhead. Available information indicates that the natural river option is the only option that can meet Commission recovery standards, defined as a normative river providing 2-6% smolt-to-adult survival for inriver migrants. Therefore, the Commission supports continued state and regional consideration of the natural river option so that a fully informed decision can be made by the region in 1999.

The Commission recognizes some outside disagreement that smolt transportation has not compensated for adverse impacts of the dams. The Commission directs staff to continue working in PATH and other regional forums to help refine and analyze options and ensure the 1999 Decision Point is not deferred. If the regional process finds convincing new evidence or develops new alternative recovery plans, the Commission will evaluate that information to determine if recovery of Idaho's salmon and steelhead can be accomplished.

The Commission is committed to giving the natural river option and all others the best possible consideration through the 1999 Decision Point process. This will require an open and active discussion of social, economic and political issues, and a thorough assessment of social and economic mitigation options to best preserve Idaho's interests.

The Commission directs the Department to make a preliminary assessment of "next best" strategies both as to interim applicability and fall-back in the event the natural river option is not adopted. At this time, the Commission does not consider Snake River spillway crest drawdown or large-scale flow augmentation to be viable long term recovery options.

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[1] This information is primarily summarized in the Department staff report *Idaho's Anadromous Fish Stocks: Their Status and Recovery Options* submitted May 1, 1998, and accepted and approved by the Commission May 7, 1998. This report includes both internal Department analyses and information from outside sources.

[2] Identified in the *1999* Decision Point process as removal of the earthen portion of the four lower Snake River dams in Washington to restore a natural river between Lewiston and Pasco. This option is being analyzed with existing flow augmentation and flow augmentation reduced to zero, and with or without John Day reservoir lowered to spillway crest or natural river.

The Commission also directs the Department to distribute the report *Idaho's Anadromous Fish Stocks* to peers, decision makers and the public. This should be done to disseminate information and encourage comments, suggestions and critique to add to our information base.

The Commission reaffirms its position that the region must not defer the 1999 Decision Point if the federal operating agencies are to avoid jeopardizing the continued existence and recovery of Idaho's wild salmon and steelhead. Pending the 1999 Decision Point, existing State and Commission interim migration policies[3] should be followed in an adaptive management framework. These include optimizing inriver migration conditions as best possible given existing constraints, and spreading the risk accordingly between inriver and transported smolts based on river conditions. These interim migration strategies should be reassessed if the 1999 Decision Point is deferred to identify operations that can provide better survival. The Department should also continue ongoing efforts within harvest, hatchery and land management forums, as well as management discussions on lower river and estuary predator control.

The Commission recognizes that meeting the biological needs of the fish is only one piece of the recovery puzzle. Social and economic concerns must also be considered, and if necessary mitigated, for any recovery decision to be successful. Without broad public involvement, it is unlikely a biological solution will be politically feasible or sustainable. It is in this spirit that the Commission encourages an open and active discussion of all relevant issues among the citizens of Idaho and the northwest region.

[3] For more detail see State of Idaho comments, April 3, 1998, to NMFS on their 1998 Supplemental Biological Opinion.

State of Idaho
Department of Fish and Game
Boise, ID 83707

June 5, 1998

MEMORANDUM

TO: Department Employees

FROM: Steve Mealey, Director

SUBJECT: Commission Salmon and Steelhead Policy

I am very pleased to send the attached Commission policy letter *Limiting Factors and Recovery Options for Anadromous Fish Stocks in Idaho.* This represents a significant milestone in ongoing efforts by the Department and Commission to "preserve, protect and perpetuate" Idaho's wild salmon and steelhead. Please read the letter carefully and contact the Director if you need clarification or have questions.

It is extremely important that we all understand exactly what the policy does and doesn't say, and how it fits into our statutory responsibilities as stewards for Idaho's fish and wildlife resources. As you are well aware, this issue is highly controversial and politically charged. As long as we stick to the letter of the policy we will be able to navigate these controversial waters successfully and continue our leadership role in salmon and steelhead recovery.

Given information available at this time, the Commission Policy: 1) accepted the Department staff report on the science; 2) determined that the dam and reservoir system in the lower Snake and Columbia rivers is the primary factor limiting recovery, and that to date the smolt transportation program has failed to compensate for the hydrosystem; 3) determined that the "natural river option" is the best biological choice for recovery, and the only option that can meet Commission recovery standards; and 4) clarified the Commission's and Department's role as an authority on the biological components of the decision process, but not an authority on the equally important social and economic components of recovery decisions.

This last point is very important if we are to maintain our credibility and leadership role in the science of salmon and steelhead recovery. Our message on the biology should be clear and strong. But we must not convey ourselves as experts or authorities in the social and economic debate of recovery options. We must be clear that neither the Department nor the Commission has advocated

the "natural river option" as best for society. We have clarified the biological component of the decision only. It is now up to others to clarify the social and economic components so that the National Marine Fisheries Service, regional decision-makers and society can make an informed decision by the end of 1999. The Commission also intends that the Department continue to be involved in the PATH process and bring any new related information to the Commission that could result in updating Department and Commission policy. Simply put our policy on anadromous fish will adapt to new biological information.

I am very proud of the leadership shown by the Commission and Department. I believe the Department staff report and the Commission Policy Statement will help hold the regional scientific process accountable, and hopefully allow the focus of the debate to shift to social and economic components pivotal to the 1999 decision.

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THEIR STATUS & RECOVERY OPTIONS

(A Report by Department Staff to the Director)

May 1, 1998

INTRODUCTION

The Department and Commission's statutory responsibility and authority is to determine what is best for Idaho's salmon and steelhead in order to preserve, protect, perpetuate, and manage them for Idahoans (Idaho Code 36-103[a]). As such, they are the primary advocates for fish in Idaho.

This report was produced in response to direction given by the Director after the April 1998 Commission meeting. It is intended to increase the Commission's comfort level that Department data and conclusions are accurate. It should also be background information for the Commission to consider prior to providing input to the National Marine Fisheries Service (NMFS) for the 1999 Decision Point.

In this report we do the following:

1. List key State of Idaho, Commission and Department policy statements regarding anadromous fish.

2. Establish information supporting the hydrosystem as the cause of the decline and continued depressed State of Idaho's anadromous fish stocks.

3. Examine options for fish recovery.

We include an appendix to this report that includes summaries of many documents cited in this report, allowing closer examination. A copy of comprehensive documents such as Plan for Analyzing and Testing Hypotheses (PATH) reports are available for review on request. Staff summaries of pertinent information from these documents are included in Appendix 2.

IDAHO POLICY STATEMENTS REGARDING ANADROMOUS FISH

Idaho Department of Fish and Game *Fisheries Management Plan for 1996-2000.* Approved by the Commission in October 1995, Pages 20 and 31. (Appendix 1.1)

> "A primary factor in the decline of Idaho's once productive anadromous stocks has been the development of the Snake and Columbia rivers' hydroelectric system."
>
> "The long range goals of the anadromous fish program are to. . . secure adequate migration conditions to increase smolt and adult survival."

Idaho Fish and Game Commission, *Fish and* Game *Commission Policy Paper: Salmon and Steelhead Recovery,* April 18, 1996. (Appendix 1.2)

> "Although a regional solution will be required to recover Idaho's salmon and steelhead, these fish are first and foremost the heritage of the citizens and tribes within Idaho. We will not abrogate our responsibility toward this heritage, even if federal agencies and other interests continue to do so."
>
> "Efforts should strive to recreate, as closely as possible, the natural migration conditions under which salmon and steelhead evolved."

***Anadromous Fish Recovery:* 1999 *Decision Point* IFG Commission Position Statement, August 15, 1997.** (Appendix 1.3 for Entire Document)

> "The legal mandate for the Commission is to preserve, protect, and perpetuate Idaho's wildlife for use by its citizens. The Commission believes a normative river is clearly the best biological route to meet that mandate, recover salmon and steelhead, and restore fisheries in Idaho."
>
> "The activities must be given top priority to ensure the 1999 decision is not deferred or made without the benefit of an honest and open debate of the relevant issues. Neither the fish nor the region can afford to delay implementation of an effective strategy to restore the runs to Idaho."
>
> "The criteria for recovery of fisheries lost due to construction and operation of mainstem dams must pivot on smolt-to-adult survival in the 2-6% range for Idaho wild salmon and steelhead. Delay of the decision is also unacceptable because delay defaults operations to continued collection and transportation, which cannot provide return rates necessary for wild fish recovery. Continuance of the status quo will lead to functional, if not complete extinction of the runs. It is therefore the Commission's position that smolt collection and barging should be

phased-out in favor of a comprehensive program to increase the survival of in-river migrants to levels necessary for recovery."

***IF&G Commission and the Natural River Option - Guest* Editorial, January 13, 1998.**
(Appendix 1.4 for entire editorial)

"Idaho's wild salmon and steelhead are imperiled and decisions about their survival must be made soon."

"In August 1997, the Commission adopted a position advocating a more 'normative' river and phasing out smolt transportation. This position, aimed at the 1999 Decision Point includes: .' . . a normative river is clearly the best biological route ... ' ' ... ensure the 1999 decision is not deferred or made without the benefit of an honest and open debate of the relevant issues.' ' . collection and transportation . . . cannot provide return rates necessary for wild fish recovery.' ' . . . smolt collection and barging should be phased-out ... ' "

"Our piece of the puzzle is biology, and if biology was the only consideration, the choice would be clear; the 'normative' river approach is best. Even the NMFS recognizes this, as is evidenced by its recent statement, 'Natural river drawdown is the long term recovery option with the greatest degree of scientific certainty.' "

"The 1999 Decision Point is vital to recovery."

"We fear that the decline of our wild salmon and steelhead will be irreversible if the 1999 Decision Point is allowed to slide or be set back."

Idaho's comments to NMFS on Draft Supplemental Biological Opinion of the FCRPS from Governor Batt,* April *3, 1998. (Appendix 1.5. For entire comments)

"Idaho's goal is to recover wild Snake River salmon and steelhead populations and restore productive salmon and steelhead fisheries. It is clear that neither the current smolt transportation program nor current in-river migration conditions will provide recovery."

"To provide recovery, Idaho believes long term direction must improve in-river conditions enough to provide sustainable 2-6% smolt-to-adult survival."

"Idaho also believes the smolt transportation program should be phased out as river conditions improve. This approach is consistent with the Independent Scientific Group's (now called the

Independent Scientific Advisory Board (Science Board)) assessment that a "normative"[1] river is the only scientifically credible route to recovery (Williams et al. 1996, 1998)."

"Preliminary analyses from PATH for spring/summer chinook also indicate smolt transportation is unlikely to provide recovery (Marmorek and Peters 1998)."

"Idaho's salmon and steelhead prospered for thousands of years by utilizing headwater tributaries for spawning and nursery areas and then sending their young to the ocean on the wave of snowmelt each spring. The ecosystem that nurtured this process as recent as 30 years ago remains largely intact except for the fact that the wave of snowmelt now slows to a crawl as it leaves Idaho at Lewiston. The remaining 400 miles to the ocean includes a series of eight dams and reservoirs in the lower Snake and Columbia rivers. This impounded reach has lost many of the ecosystem components required for successful migration (Williams et al. 1996). This altered environment results in slower migration, increased stress, direct mortality and greater exposure to predators."

"Flow augmentation is not a long-term solution to this dilemma."

Letter to Governor Batt from IFG Commission, April 6, 1998. (Appendix 1.6. For entire letter)

"It is becoming increasingly clear that the natural river option may be the best, and perhaps only, way to restore Idaho's wild salmon and steelhead. The Commission has not officially advocated the natural river option, or any other option at this time. The Commission has joined the State of Idaho in advocating a long-term solution that embraces the "normative" river and phases out smolt transportation. As the 1999 Decision Point nears, the Commission is likely to endorse one of the three recovery options as the best biological choice based on available scientific information."

CAUSES OF DECLINE AND FACTORS LIMITING RECOVERY

Many natural and artificial fluctuations and changes to the fishes' ecosystem have occurred over time. The most dramatic changes resulted from human development of the region, and included overharvest of adults, hydropower development, flood control, water diversion and storage for irrigation, grazing, logging, mining, and commerce. There have also been natural disturbances,

---

[1] Normative is defined by the Independent Scientific Group as "... an ecosystem where specific functional norms or standards that are essential to maintain diverse and productive populations are provided." (Williams et al. 1996). Idaho does not view the normative approach as a specific set of recommendations, but as a guiding premise from which to develop, assess and prioritize potential recovery actions. For example, large scale flow augmentation and smolt transportation are actions inconsistent with the normative approach, whereas efforts to recreate a natural hydrograph would be an action consistent with the normative approach.

such as drought, floods, fire and shifts in ocean productivity and predator cycles. These natural events are important regulators of population abundance and are part of the natural evolutionary legacy of Idaho's wild salmon and steelhead and are not the primary cause of the current crisis facing these fish (NMFS 1995; Harza Northwest 1996; Marmorek and Peters 1996; Williams et al. 1996; Harrison 1998; Stelle 1998).

It is unrealistic to assume society can restore the ecosystem to pristine pre-European development conditions and regain the estimated 1.5 million spring/summer chinook salmon adults that returned to the Snake River annually (Matthews and Waples 1991). But we do not have to go back in time very far to find ecosystem conditions that supported stable and viable runs of wild salmon and steelhead. During the 1960s wild salmon and steelhead runs into the Snake River averaged over 100,000 adults annually (Figure 1). These runs provided sustainable natural production and consistent tribal, sport and commercial fisheries.

Idaho's wild salmon and steelhead declined dramatically in the mid and late 1970s and have not recovered (Figure 1). Currently all of Idaho's native salmon and steelhead are either extinct or threatened with extinction. Snake River coho salmon were declared extinct in 1986. Sockeye and chinook were listed as endangered and threatened, respectively, under the federal Endangered Species Act (ESA) in 1991 and 1992. Steelhead were added to this list as threatened in 1997.

It is generally accepted that hydropower development on the lower Snake and Columbia rivers is the primary cause of decline and continued suppression of Snake River salmon and steelhead (USGAO 1990; CBFWA 1991a; NPPC 1992; NMFS 1995, 1997; NRC 1995; Williams et al. 1996; State of Idaho 1997; State of Idaho 1998). The region is particularly unified with respect to mainstem hydropower development being the primary cause of decline; there is less unified agreement that the hydropower system is the primary factor currently limiting recovery (Marmorek and Peters 1998). It has been hypothesized that the detrimental effect of the dams has been compensated for by the smolt transportation program, and that high fish mortality now occurs primarily in the ocean unrelated to the mainstem dams. It is important to understand the merits, risks and uncertainties of these opposing hypotheses in order to implement effective recovery measures.

Two primary aggregate hypotheses regarding the current major factors limiting recovery are being analyzed by PATH scientists[2]. Appendix 3.6 provides a summary of these hypotheses.

State and Tribal Hypothesis: In basic terms, the aggregate hypothesis developed and supported by the state and tribal salmon managers states that cumulative direct and delayed mortality of juveniles and adults associated with the mainstem hydropower system has not been compensated for by the smolt transportation program and recent dam improvements. The primary reason smolt transportation has failed to compensate for the dams is the delayed mortality associated with stress

[2] PATH (Plan for Analyzing and Testing Hypotheses) is a scientific forum initiated by NMFS to help bring regional resolution to conflicting decline and recovery hypotheses. The forum includes federal, state, tribal, university and private consultant representation, and incorporates independent peer review.

from reservoir and dam passage, collection, handling, barging and disruption of natural migration timing.

Alternative Hypothesis: In basic terms, the alternative aggregate hypothesis developed and supported by BPA, COE and some of NMFS' scientists states that the smolt transportation program and recent dam improvements have compensated for direct and delayed mortality associated with the mainstem hydrosytem. The primary reason adults are not returning to Idaho is due to a mid-1970s shift in ocean conditions, coupled with disease, genetics, predators, and other unspecified factors that cause selectively high ocean mortality for upriver stocks.

PATH is currently modeling predicted outcomes of recovery options based on these two hypotheses. They have completed preliminary results for spring/summer chinook (Marmorek and Peters 1998) and are currently working on model runs for fall chinook, followed by steelhead. PATH has not yet fully analyzed which aggregate hypothesis has the best ecological rationale and scientific support. PATH will attempt to resolve this important issue next fall and winter. Currently, both hypotheses are being modeled equally.

Department staff believe the level of ecological and scientific support for the state and tribal hypothesis, and the level of ecological and scientific uncertainty for the alternative hypothesis, do not warrant delay in clarifying the primary factor limiting recovery. Without this clarification we believe the 1999 Decision Point will likely be deferred.

The 1950s and 1960s provide a reasonable standard for recovery. The Commission, State of Idaho and NMFS have adopted a 2-6% smolt-to-adult survival standard for recovery based on this earlier time period (Toole et al. 1996; IFG Commission 1997; State of Idaho 1998). We examine the following factors in the context of what has changed dramatically in the fishes ecosystem since this period of sustainable runs thirty to forty years ago.

Spawning and Rearing Habitat

The quality of Idaho's salmon and steelhead habitat range from pristine to degraded to inaccessible, but no significant deterioration in the condition of accessible habitat has occurred since the 1960s that could account for the dramatic decline in fish numbers (Marmorek and Peters 1996; Appendix 2.3). Important spawning and rearing areas have been blocked by dam construction during this time period, but this cannot account for reduced escapements into accessible areas. Idaho currently has about 3,700 total miles of spawning and/or rearing habitat for spring/summer chinook, which represents 62% of predevelopment condition (Hassemer et al. 1997, Appendix 3.12). Approximately 30% of the habitat is located within boundaries of designated wilderness or wild and scenic river corridors (State of Idaho 1991; Appendix 3.12) and has been protected from development. Idaho's current habitat could produce several million smolts (IDFG et al. 1990; NPT and IDFG 1990, IDFG 1992a).

Adult escapements into accessible habitat have declined dramatically since the 1960s, regardless of the relative quality of the habitat (Figure 2; Appendix 3.12). In contrast, the productivity or survival of juvenile salmon and steelhead in these freshwater habitats has declined only slightly since the 1960s (Petrosky and Schaller 1996; Appendix 3.12).

The quantity and quality of habitat in Idaho does not preclude recovery of wild Snake River salmon and steelhead. Habitat protection remains important in helping ensure the persistence and resilience of the species (Quigley and Arbelbide 1997; Appendix 3.12).

Migration Habitat

Idaho's spring migrating salmon and steelhead prospered for thousands of years by utilizing headwater tributaries for spawning and nursery areas and then sending their young to the ocean on the wave of snowmelt each spring. The most important change to the ecosystem that nurtured this process as recent as 30 years ago is the construction of additional dams on the lower Snake and Columbia rivers in Washington. The dramatic decline of Idaho's salmon and steelhead coincides directly with completion of these dams (Figure 1). The newly impounded reach lost many of the ecosystem components historically required by steelhead and salmon for smolt migration (e.g., relatively unimpeded passage without dams, substrate and riparian cover for resting and predator avoidance, high water velocity and velocity gradients, preferred temperatures, etc.) Williams et al. 1996).

Water velocity, which is only one component of the complex ecosystem requirements of migrating salmon and steelhead smolts, is up to 15 times slower in the lower Snake River reservoirs than in the natural river (CBFWA 1991b; IDFG and IDWR 1993; Dreher 1998). This altered environment results in slower migration and greater exposure to predators. Historically, Idaho's salmon and steelhead smolts migrated through the lower Snake and Columbia rivers in less than two weeks, which was crucial to their physiological changes from a freshwater to saltwater fish. The journey for in-river migrants now requires two to three times longer as a result of the slack water (Raymond 1979).

Independent scientists, hired by the Northwest Power Planning Council to assess their recovery plan, were very clear regarding the dams in their *Return to the River* document.

> "Key among the conditions we define as normative is the availability of a continuum of high-quality habitat throughout the salmon life cycle, from freshwater streams along the entire migratory path into and back out of the Pacific Ocean.... The dams severed the continuum of habitat, leaving very little riverine habitat left in the mainstem and isolating other types of habitat." (Williams et al. 1996).

PATH scientists reported in their conclusions document:

> "We are highly confident that the differences in stream-type chinook indicators of productivity and survival rates between upstream (Snake River sub-basins) and downstream (Lower Columbia sub-basin) stocks are coincident in space and time with development of the hydrosystem."
>
> "We are reasonably confident that aggregate effects of the hydrosystem have contributed to reduced survival rates of Snake River stocks during the post-1974 period, as compared to the pre-1970 period."

> "We are reasonably confident that the hydrosystem has contributed to decreased juvenile survival in the downstream corridor for Snake River stocks in the post-1974 period." (Marmorek and Peters 1996).

Some groups claim the development of Idaho's upriver irrigation storage and flood control reservoirs is to blame for the loss of good springtime migration flows in the lower Snake River. Analysis shows that these reservoirs have minimal impact on springtime and summer water velocity and flows (IDFG and IDWR 1993; Dreher 1998). In contrast, construction of dams in the lower Snake River during the 1960s and early 1970s significantly reduced water velocity and altered numerous other ecosystem components vital to migrating fish (NMFS 1995; Williams et al. 1996; Dreher 1998).

The smolt transportation program was implemented in the mid-1970s in an attempt to compensate for adverse migration conditions caused by hydropower development. Available data and scientific reviews indicate smolt transportation has not compensated for the dams and is unlikely to provide recovery (Appendices 3.11 and 3.12).

Estuary and Ocean Conditions

Estuary and ocean conditions are important regulators of population abundance but are not the primary factors limiting recovery of Idaho's salmon and steelhead (Harrison 1998; Stelle 1998; Appendices 3.2 and 3.6). Cyclic and stochastic fluctuations in ocean productivity, temperature and predators have occurred for thousands of years and are part of the evolutionary legacy of anadromous fish. These conditions can have a profound effect on survival and relative year-class strength of Idaho's salmon and steelhead, but can these conditions account for the dramatic decline toward extinction since the 1960s?

Dr. Robert Francis, an oceanographer from the University of Washington and member of the Independent Scientific Review Panel states:

> "I know some people will look at this data [declining salmon runs] and say, it's the ocean's fault. I would say that it's clearly not the ocean's fault. Salmon have survived changing ocean conditions for thousands of years, but the big decline in the runs occurred in recent decades. So you have to ask yourself, what's occurred during that time, -- what's different? And the clear answer is man's impact, -- dams, habitat destruction, overfishing, hatcheries. We can't use the ocean as an excuse to stop our efforts to improve passage, spawning and rearing conditions." (Harrison 1998).

This view was echoed recently by Will Stelle, Jr., Regional Administrator for the National Marine Fisheries Service, in a guest opinion editorial to the Portland *Oregonian* newspaper:

> "Some argue that it's the ocean, and so we should relax and wait until the ocean turns around. Wrong." (Stelle 1998).

The importance of ocean conditions and variability must be kept in proper context. Wide annual and periodic fluctuations in adult returns are common for salmon and steelhead. Prior to the

1970s, strong stock productivity and abundance helped absorb these fluctuations without risk of extinction. Since the 1960s, low stock productivity and abundance resulting from hydropower development leave little room to absorb these natural shifts in ocean conditions, further elevating the risk of extinction.

The PATH process has helped examine the plausibility of estuary and ocean conditions being responsible for the current imperiled status of Snake River salmon (Marmorek and Peters 1996). If estuary/ocean conditions {e.g., nutrients, temperature, forage) and predators (e.g., penniped, avian) are the primary limiting factor, then downriver stocks that exhibit similar life history patterns should also be severely depressed. PATH scientists compared several spring chinook stocks from Snake River tributaries with similar spring chinook stocks from downriver tributaries. These upriver and downriver stocks migrate at similar age, time and size, enter the estuary at similar times, have similar distributions in the ocean, and return as adults at similar age, time and size. The most significant difference in their life cycle is the lower stocks originate above one to three dams, whereas the upriver stocks originate above eight dams. All of these fish should experience similar conditions and predators in the estuary and ocean.

PATH scientists found common effects from ocean conditions for upriver and downriver stocks, but that upriver stocks suffered a significant decline in survival and abundance after the 1960s that was not evident in downriver stocks (Marmorek and Peters 1996; Appendix 2.3; Figure 4). This decline coincided with completion of the lower Snake River dams (Marmorek and Peters 1996; Appendix 2.3; Figure 3). Since that divergence, relative survival of Snake River stocks is typically two to five times lower than the downriver stocks (Appendix 2.3; Figure 5). Only during the mid-1980s did upriver stocks get within 80% of their downriver counterparts, -- these were generally good water years with high flow and spill during smolt migration.

Based on these conclusions, if smolt transportation has compensated for the dams and the estuary and ocean are now the primary factors limiting Idaho salmon and steelhead, then ocean conditions and predators must be selective against Snake River fish, but still unrelated to the hydroelectric system. Available data does not support this line of reasoning (Appendices 3.2, 3.3, 3.4, 3.5, 3.6 3.7, 3.9, 3.10, 3.11, 3.12, 3.13). The biological rationale and mechanisms that could logically describe how ocean and estuary conditions unrelated to the hydroelectric system would systematically kill two to five times more Snake River fish than similar downriver fish has not been clearly identified. The biological rationale that we are aware of, proposes that elevated disease, hatchery influence and poor genetics in Snake River fish may account for the difference in survival compared to downriver stocks (Marmorek and Peters 1998). We describe in the following section why this hypothesis is not scientifically supportable.

Hatcheries, Disease and Genetics

In their conclusions document,' PATH scientists state:

> "Preliminary results suggest that artificial propagation of spring/summer chinook has not significantly contributed to declines in wild populations of spring/summer chinook in upstream areas (Snake and upper Columbia rivers) between pre-1970 and post-1974." (Marmorek and Peters 1996)

Hatchery production has increased dramatically in the Snake River Basin since construction of the lower Snake River, Hells Canyon Complex and Dworshak dams (Figure 6). Some claim that this increase in hatchery production is responsible for the decline and continued suppression of wild Snake River salmon and steelhead. The increase in hatchery production is actually *in response to* the decline in fish numbers, not the cause of this decline.

During this period, the Department and Commission made every effort to ensure increased hatchery production did not adversely affect remaining wild salmon and steelhead populations. This included designating large basins as genetic refuges off limits to hatchery production. These areas include the Middle Fork Salmon (steelhead and chinook), South Fork Salmon (steelhead) and Selway (steelhead) rivers. Numerous other drainages received little or no hatchery outplants. The Department also implemented progressive hatchery practices designed to minimize adverse hatchery impacts and accentuate benefits to natural production (Bowles and Leitzinger 1991; IDFG 1992a; Bowles 1993; IDFG 1994; Bowles 1995).

There is no evidence that fish pathogens associated with hatchery practices are responsible for the decline or continued suppression of Idaho's wild salmon and steelhead (Appendix 3.3). Bacterial kidney disease (BKD) is present in both wild and hatchery chinook, but prevalence and level are low, particularly in wild fish. The highest risk for disease infection and amplification among hatchery and wild fish is associated with the smolt transportation program (Appendix 3.3). Researchers have demonstrated that the stress and close quarters associated with the smolt collection and transportation programs is a primary catalyst for disease outbreak and transmission (Appendix 3.3).

There is no evidence that the genetic makeup of Idaho's wild salmon and steelhead has been altered significantly, or that genetic makeup and associated fitness have been reduced enough to diminish recovery potential (Appendix 3.4). If genetic fitness has been reduced, egg-to-smolt survival should also be reduced. Egg-to-smolt survival has declined only slightly since the dams were completed in the lower Snake River, whereas smolt to adult survival has declined dramatically (Marmorek and Peters 1996; Appendix 3.12). Reduced genetic fitness would also be expressed in reduced resiliency, or the ability of populations to respond when environmental conditions are favorable. Wild Snake River salmon and steelhead populations show resiliency, as demonstrated in strong adult returns associated with good flow and spill conditions in the mid-1980s (Bowles 1993) and 1995.

Harvest

There is no evidence that harvest limits recovery of Idaho's wild spring/summer chinook salmon (Appendix 3.10). Prior to completion of the lower Snake River dams, cumulative harvest rates typically exceeded 60%, yet wild runs remained stable and strong. Since completion of the lower Snake River dams, average harvest rates for all fisheries have been reduced to less than 10%, yet wild runs continue to decline (Appendix 3.10).

Current harvest rates have more significant impact for wild Snake River B-run steelhead and fall chinook (Appendix 3.10). Approximately one-third of Idaho's wild B-run steelhead are harvested in tribal fisheries in the Columbia River. Over 50% of Snake River fall chinook are harvested in

ocean and lower Columbia River fisheries. Although these losses to harvest are far less than juvenile and adult mortality associated with dam and reservoir passage, it is still an important limitation to recovery (State of Idaho 1997). The Department and Attorney General's Office are regional leaders in advocating harvest restrictions consistent with conservation objectives.

The Commission and State of Idaho strongly support restoring full harvest opportunities to sport, tribal and commercial fisheries.

> "Idaho views weak stock constraints as an unfortunate but necessary measure until escapement goals are met. Once again, the best way to reduce weak stock constraints over the long-term is to rebuild runs of wild Snake River steelhead [and fall chinook] by improving mainstem migration conditions and implementing near-term harvest restrictions." (State of Idaho 1997).

> "Harvestable surpluses are clearly our long-term goal. Harvest must be limited to those fish not essential to future production. The Commission recognizes the need to not overly constrain ocean and lower-river fisheries, but maintains that escapement and genetic diversity within and between populations is a mandatory conservation requirement." (IFG Commission 1996).

The Commission has adopted conservative harvest regulations for in-state fisheries. It has been illegal to harvest wild adult salmon in Idaho since the late-1970s and wild steelhead since the mid-1980s. Idaho has not had a state-wide general chinook fishery for 20 years. Limited fisheries near some hatcheries have occurred infrequently; any wild fish caught were released immediately.

Conclusion on Limiting Factors

This scientific assessment points to the construction and operation of additional mainstem dams in the late 1960s and early 1970s as the primary factor limiting recovery of Idaho's salmon and steelhead. This conclusion has been the official position of the Department, Commission and State of Idaho for the past two decades (IDFG 1978; State of Idaho 1990; IDFG 1992a; IDFG 1996; State of Idaho 1996, IFG Commission 1996; IFG Commission 1997; State of Idaho 1997; State of Idaho 1998). This reassessment has not provided any scientific basis for changing this position; instead the data and recent scientific publications strengthen the conclusion that the dams are still the primary problem, and support the conclusion that smolt transportation has not fully compensated for the mainstem hydrosystem.

WHAT CAN BE DONE TO RECOVER THE FISH?

The rest of this paper proceeds from the basis that the mainstem dams continue to be the primary factor limiting recovery of wild Snake River salmon and steelhead, and that recovery actions must embrace the "normative river" in order to meet the biological requirements of the fish. We define the normative river as providing enough natural ecosystem functions in the river to allow sustainable 2-6% smolt-to-adult survival.

1999 Decision Point

The National Marine Fisheries Service (NMFS), the federal agency responsible for salmon and steelhead recovery within the Endangered Species Act (ESA), has committed to make a decision on how to recover Idaho's salmon and steelhead by the end of 1999. This commitment is known as the 1999 Decision Point, and is a requirement of NMFS' 1995 and 1998 biological opinions on operation of the Federal Columbia River Power System (FCRPS) (NMFS 1995, 1998). Litigation by the Department and others in 1993 was the primary catalyst for this federal commitment to the 1999 Decision Point (NMFS 1995).

Recovery options being assessed for the 1999 Decision Point fall into three basic categories:

1) Status quo smolt barging and flow augmentation (full smolt transportation, Dworshak and Brownlee drawdown plus 427 thousand-acre-feet flow augmentation from upper Snake River).

2) New and improved smolt barging and flow augmentation (surface collectors, reduced spill, more barges, greater proportion of fish barged, Dworshak and Brownlee drawdown plus existing or 1-3 million-acre-feet additional flow augmentation from upper Snake River).

3) Natural river option (natural river in lower Snake River between Lewiston and Pasco; perhaps John Day to spillway crest or natural river; Dworshak, Brownlee and upper Snake River flow augmentation at existing levels or reduced to zero).

Approximately 13 different operational scenarios are being analyzed within these categories to aid the decision process (Appendix 3.14). These options were arrived at by the states, tribes, and federal government within the regional forum.

The following section describes the Department's assessment of existing information on the three recovery approaches and their ability to recover Idaho's salmon and steelhead. PATH scientists estimate that recovery measures must provide 2-6% smolt-to-adult survival to provide sustainable salmon recovery (Toole et at. 1996; Marmorek and Peters 1996, 1998, p.xi, p.87, B-32). The survival standard for steelhead may be slightly higher based on historical smolt-to-adult survival and lower egg-to-smolt survival. These standards provide a useful "yardstick" to assess recovery options. Improvements to mainstem migration conditions must provide a minimum two- to five-fold increase in survival over existing actions in order to bring Idaho stocks back in line with their downriver counterparts and provide recovery.

Status Quo Smolt Barging and Flow Augmentation

The preferred federal approach to salmon and steelhead recovery has been to utilize water from upriver storage reservoirs to help flush smolts to the lower Snake River dams, collect a high proportion of the smolts at these dams, then transport the smolts in barges and trucks for release below Bonneville Dam on the lower Columbia River (NMFS 1995). There is no scientific basis for assuming this approach will recover Idaho's wild salmon and steelhead. Following successful litigation by the Department and others, NMFS concluded that current operations were likely to

jeopardize the continued existence of Snake River salmon (NMFS 1995). This conclusion precipitated the 1999 Decision Point.

Full implementation of the smolt transportation program has been in place since the mid-1970s. Available data provide no indication that this program can sustain 2-6% smolt-to-adult survival (Appendix 3.13; Figure 7). Preliminary prospective analyses by PATH scientists found current smolt transport and flow augmentation inadequate to sustain 2-6% smolt-to-adult survival, regardless of the underlying aggregate hypothesis driving the model (Appendix 2.4; Figure 8) (Marmorek and Peters 1998). Status quo operations also failed to meet PATH's 24- and 100-year survival standards and 48-year recovery standard.

Enhanced Smolt Barging and Flow Augmentation

The enhanced smolt transportation and flow augmentation option is more difficult to assess because proposed improvements have not been fully developed or tested. This option includes: surface collectors to reduce smolt collection stress and increase the percentage of smolts transported; more barges and larger exit holes in the barges to reduce transport crowding and stress; and likely additional Idaho water to help flush smolts to the collection system and aid inriver migrants.

Surface collectors are a key element of this option, but the technology is unprecedented, and whether it can be developed and implemented is highly uncertain (Appendix 3.8). Potential benefit of surface collectors is limited to reducing stress of smolt collection. It does not address the dilemma of transportation stress, stress associated with altered migration timing from barging, genetic selectivity of the transportation program, and imprinting concerns (Williams et al. 1998).

Corps research so far has focused on whether smolts can be guided to spillways. Results of this effort last year were quite discouraging (Appendix 3.8). Research is ongoing in 1998, with initial results anticipated during May. Even if smolts are successfully guided to the spillway, the biggest challenge for the surface collector is to route these fish to the barges without elevated stress. This requires developing the technology to de-water the collection system without stressing the fish, -- this has never been attempted before and is a tremendous engineering challenge (Appendix 3.8). Department scientists tracking this process believe this technology is at least ten years out, with even a longer time period for testing and full implementation.

Surface bypass or surface collection focus on dam passage only, and will not reduce mortality associated with getting smolts through the reservoirs to be collected, or mortality of inriver migrants passing through multiple mainstem reservoirs. The enhanced transportation and flow augmentation option utilizes Idaho water to help flush smolts through these mainstem reservoirs.

Available data indicates that, under full mainstem reservoirs in the lower Snake River, salmon and steelhead survival is typically higher for years when smolts outmigrated in relatively high flow and spill, than in years when flow and spill were low (Figure 9) (NMFS 1995, 1998). This relationship is particularly evident for Snake River fall chinook, which outmigrate during July and August when Idaho water is least available. This data does not indicate flow augmentation can provide enough survival benefits for recovery.

The flow component is the only element of the enhanced transportation and flow augmentation option that has data supporting it. Although we do not believe flow augmentation can provide recovery, we are concerned that the only way selection of this option may survive the inevitable litigation, would be if additional flow augmentation were a key component. This option has highly uncertain biological benefits and significant risk to Idaho interests, as evidenced in the following State of Idaho position.

> "To aid in-river smolt passage through lower Snake and Columbia reservoirs, managers must shape limited available water to help recreate the natural migration characteristics these fish evolved under. Flow augmentation is not the solution to this dilemma. Most of the water reaching the lower Snake River comes from watersheds with little or no controlled storage, such as the Salmon, Clearwater, Grande Ronde and Imnaha. Only about one-third of the water reaching the lower Snake River comes from above Hells Canyon, where most of the basin's reservoirs are located. It is both unrealistic and unacceptable to use the storage reservoirs in the Snake and Clearwater basins to try to reverse the fundamental effects that the four federal dams on the lower Snake River have had on the Snake River ecosystem. Historical water velocities cannot be attained with the current reservoirs even using all reservoir storage in the basin. Simply adding more water to the system is inconsistent with the normative river approach because flow and water velocity are only two components of the complex ecosystem requirements for successful migration. Additional flows are unlikely to aid other ecosystem deficits, such as problems with natural microhabitats for resting, refuge and migration." (State of Idaho 1998).

Natural River

The natural river option has a strong scientific basis for being the best biological choice for Snake River salmon and steelhead recovery. The scientific basis includes survival, adult escapement, and fishery data collected prior to completion of the lower Snake River dams (Raymond 1988; Marmorek et al. 1996; Marmorek and Peters 1996), as well as studies on migration; predators; fish physiology and stress; hydromorphology; spawning, rearing and migration habitat preferences; and over 10,000 years of evolutionary legacy.

Biological benefits of the natural river option include: improved river conditions (e.g., velocity, temperature, turbidity, reduced dissolved gas, resting/feeding habitat), reduced fish stress (e.g., more natural travel time and ocean entry, no collection and handling, reduced crowding and disease exposure), reduced predation (e.g., fewer predators, less concentrated predators, less time exposed to predators), increased production (e.g., high probability of recovery and restored fisheries, enhanced fall chinook spawning and rearing areas, reduced hatchery/wild interaction because of reduced hatchery smolt production), sturgeon and lamprey benefits, and resident fish benefits (i.e., improved water quality and pool elevations in Dworshak, Brownlee, Cascade and American Falls reservoirs because flow augmentation for salmon will likely be reduced or eliminated).

Biological risks associated with the natural river option include: potential reduction of instream flows beneficial to resident fish in the upper Snake River because flow augmentation will likely be

reduced or eliminated, and reduced survival benefits of a free flowing river during the initial transition period when the river channel and banks are restabilizing.

The Corps of Engineers ongoing NEPA process estimates that the majority of sediment will be naturally flushed from the area within five years and potentially much faster depending on runoff conditions (Appendix 3.1). During the transition period, the benefits of a free flowing river may be partially offset by increased suspended sediment, but available data indicates the net effect on fish survival will probably still be positive (Appendix 3.1). Survival benefits will accelerate quickly following the brief transition period.

Sediment movement will not impact any important spawning areas (Appendix 3.1). All major spawning habitat for Snake River salmon and steelhead is located above this area in unimpounded reaches that will not be affected by sediment movement. In fact, the natural river option will restore spawning and rearing areas for fall chinook in the lower Snake River that are currently inundated by the mainstem reservoirs.

PATH modeling indicates the natural river option has a high likelihood of meeting recovery standards if smolt barging has not successfully compensated for the dams, and a low probability of meeting recovery standards if smolt barging has already compensated for the dams (Marmorek and Peters 1998, p.58; Figure 5.3-3, and p.B-32; Figure B.5-2). As described earlier, we find no scientific basis for concluding that the smolt transport program has compensated for the dams, and that the high mortality has shifted to some factor in the ocean that is worse for upriver fish but unrelated to the dams. There is far more empirical and theoretical certainty associated with the conclusion that the dams remain the primary factor limiting Snake River salmon and steelhead. Under the assumption that the dams are not the problem, none of the recovery options meet recovery standards, and the natural river option is only slightly worse than the smolt transportation and flow augmentation options (Figure 8; Marmorek and Peters 1998, p.58; Figure 5.3-3, and p.B-32; Figure B.5-2). Under the assumption that the dams are the problem, the natural river option provides recovery to similar levels evident in the 1950s and 1960s (Figure 8; Marmorek and Peters 1998, p.B-32; Figure B.5-2).

An earlier analysis commissioned by the Corps of Engineers also concluded that the natural river option has the highest probability of biological success (Harza Northwest 1996; Appendix 2.2).

Spillway Crest Drawdown

Spillway crest drawdown is not part of the 1999 Decision Point but is an option previously considered for recovery. As the name implies this option draws the mainstem reservoirs down to the crest of the spillway during the spring migration season. This reduction in the cross section of the pools causes the water to move faster than occurs with full pools or minimum operating pools, although still much slower than a natural river. At the end of the spring migration period, the pools would be refilled from upriver storage reservoirs (approximately one million-acre-feet) to restore full power production and commodity barging.

This option moves toward a more normative river than current operations, but is unable to provide most of the normative conditions described by the ISAB for a normative river (Williams et al. 1996).

Analysis for NMFS' 1995 Biological Opinion found this option has a better chance of recovering Idaho's spring/summer chinook than existing operations, but it was uncertain whether this option can meet recovery standards under the hypothesis that the dams are still limiting recovery (STFA 1995a, 1995b). Spillway crest drawdown performed substantially poorer than the natural river drawdown (STFA 1995a, 1995b). Spillway crest drawdown also has substantial engineering uncertainty regarding how to modify the dams to allow unstressed dam passage by juveniles and adults (Harza Northwest 1996).

One biological concern of this option is that it would degrade migration conditions for juvenile fall chinook. This is because fall chinook juveniles are summer migrants and therefore would be migrating when the mainstem reservoirs were refilling (i.e., water velocity reduced to near zero). If reservoir refill was delayed until the fall, then low water velocity and dam passage problems could impact adult steelhead and fall chinook returning in the fall.

Spillway crest drawdown is no longer one of the options being considered for the 1999 Decision Point. This option was removed from consideration in 1996 following regional consensus that cost was too high and biological benefits too uncertain. The Governor's Office (Jim Yost) and Northwest Power Planning Council (Mike Field) represented the State of Idaho in this decision process. This action was supported by a scientific analysis of the potential costs and benefits of spillway crest drawdown (Appendix 2.2; Harza Northwest 1996).

Risk Assessment

The biological risk to Idaho's salmon and steelhead is high. Current recovery actions have not reduced this risk to acceptable levels. It is relatively certain that delay or deferral of implementing long term recovery actions will increase biological risk (Marmorek and Peters 1998).

PATH analyses provide a useful context for assessing risk and uncertainty associated with recovery measures. If the dams are the problem (i.e., smolt transportation has not compensated for the dams) and the natural river option is implemented, then there is high certainty that the fish will recover (Figure 8). If the dams are not the problem (i.e., smolt transportation has compensated for the dams) and the natural river option is implemented, then the fish will likely be nearly as well off as predicted for other options (Figure 8). Therefore the biological risk of the natural river option is extremely low. The natural river option provides high certainty of biological benefits under the hypothesis that the dams are still limiting recovery.

In contrast, if the dams are the problem and the natural river option is not implemented, then there is relatively high certainty that salmon and steelhead will not recover, -- resulting in a lost opportunity for recovery. This results in a very high biological risk for smolt transportation and flow augmentation options. Based on our assessment of limiting factors and PATH modeling, these other options also have a very low certainty of biological benefits.

CONCLUSIONS

Department staff conclude that the natural river option is the best biological choice for recovering salmon and steelhead in Idaho. This assessment is logical, biologically sound, has the highest

certainty of success and lowest risk of failure, and is consistent with the preponderance of scientific data. This conclusion is consistent with current State of Idaho and Commission positions. The normative river standard adopted by the Commission and State of Idaho requires improving in-river migration conditions enough to provide sustainable 2-6% smolt-to-adult survival (IFG Commission 1997; State of Idaho 1998). It also requires phasing out smolt transportation and allowing smolts to migrate naturally in the river as river conditions improve.

The natural river option is the only option considered in the 1999 Decision Point that can provide recovery (Marmorek and Peters 1998, p.B-32; Figure B.5-2) and meet the policy positions stated above.

Other scientists in the region have also supported this conclusion:

"....if we want to go back to the harvestable runs of the 1950s, 45 years ago, there is only one way to do that: take out four lower Snake River dams and probably John Day as well. ... that is the only way to do it. We are not going to get there by tweaking the system." (Congressional Testimony by Dr. D.W. Chapman, principal author of National Academy of Science report on salmon recovery)

"... we have sought technological band-aids to repair lost ecosystem functions. If you want more fish you are going to have to manage the river more like a river. Restoration of Columbia River salmon will require changes that move the regulated river system toward a more natural set of conditions." (Dr. Rick Williams, Chairman, Independent Scientific Advisory Board)

"We find the concept that we can engineer our way out of the present crisis to be at odds with the prevailing scientific knowledge." "Furthermore, transportation alone does not appear sufficient to overcome the negative effects on survival of salmon caused by development and operation of the hydroelectric system." (Independent Scientific Advisory Board; Williams et al. 1996)

" ... permanent drawdowns and dam removal should be evaluated in terms of the social and economic costs to the region. The potential social, economic, and biological cost and benefits of implementing normative conditions should be determined and become part of the regional debate regarding salmon restoration." " ... we believe strongly that approaching more normative ecosystem conditions is the only way in which Fish and Wildlife Programs goals for recovery of salmonids and other fishes can be met." (Independent Scientific Advisory Board; Williams et al. 1996)

"Quite simply, dam removal is the biological option of choice if salmon and ecosystem restoration is the primary goal. ... No other in-river option can match this biological benefit or the speed of implementation (five years)." (Harza Northwest 1996, under contract with the Army Corps of Engineers)

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FIGURES

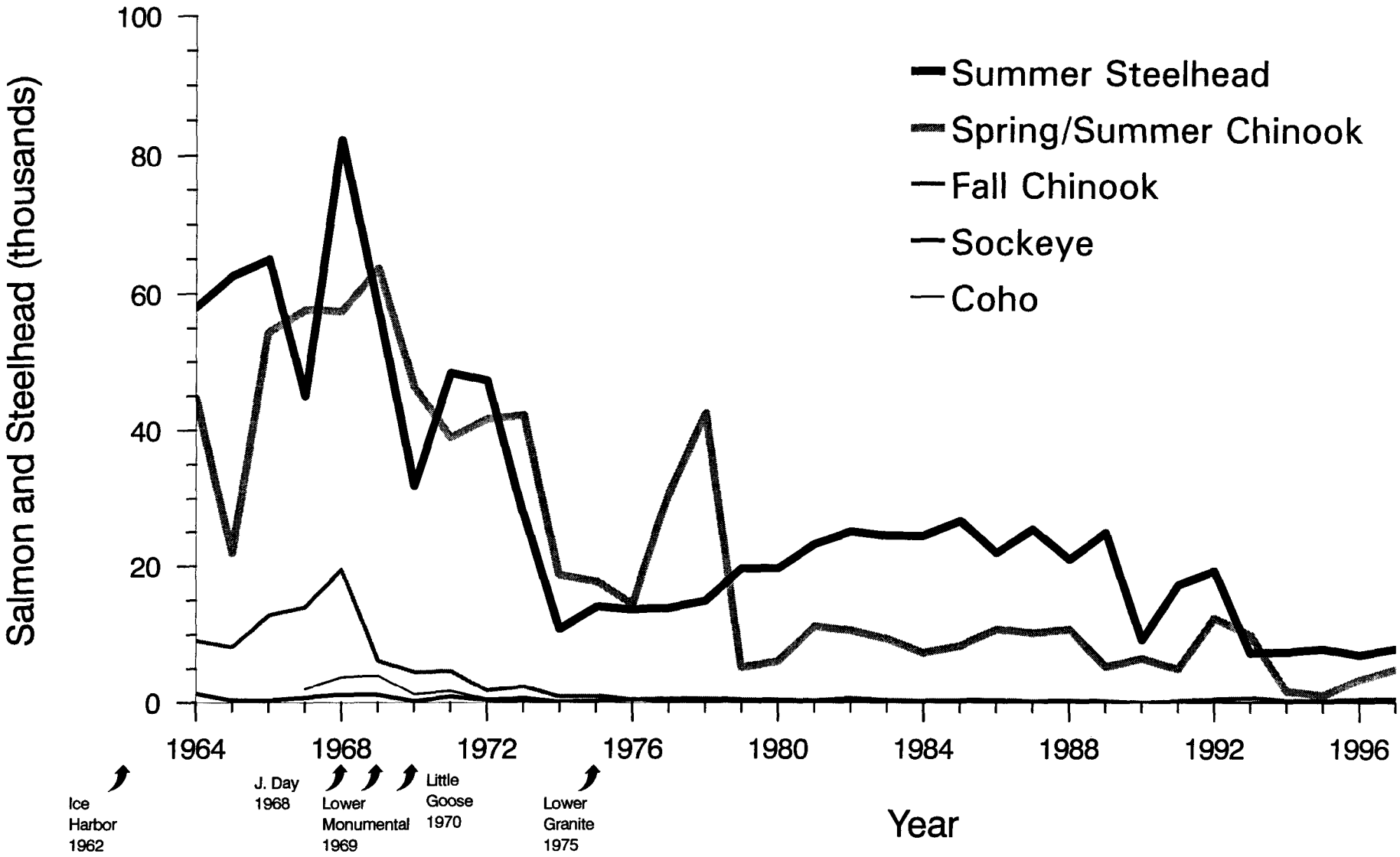

Figure 1. Adult wild salmon and steelhead counts at the uppermost dam on the Snake River below Lewiston (Ice Harbor Dam 1964-68, Lower Monumental Dam 1969, Little Goose Dam 1970-74, Lower Granite Dam 1975-97).

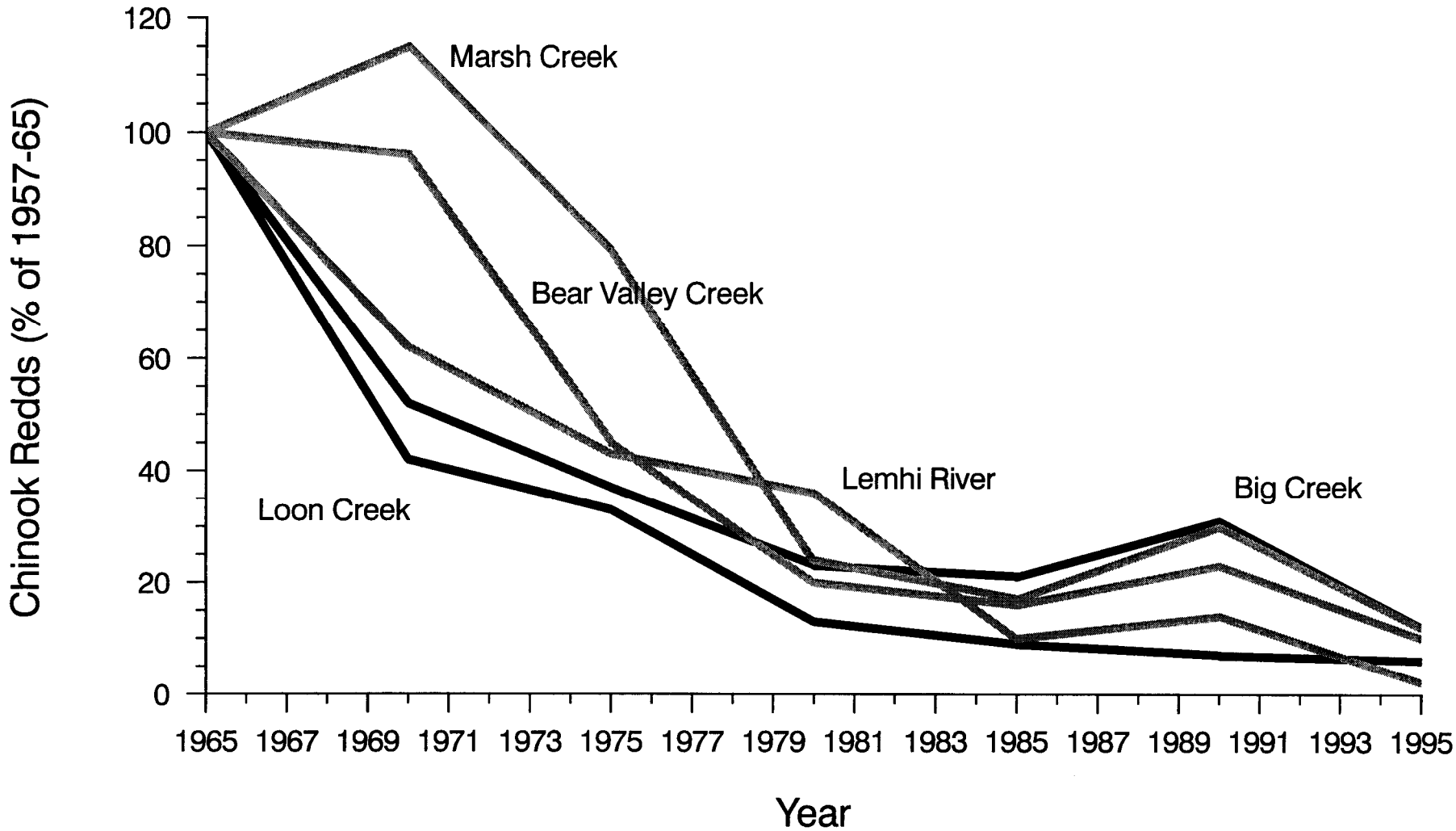

Figure 2. Trend counts of 1965-95 spring-summer chinook redds indexed as a percentage of the 1957-65 average. These streams represent a range of habitat conditions. Big and Loon creeks are wilderness watersheds. The Lemhi River, Bear Valley and Marsh creeks are managed watersheds.

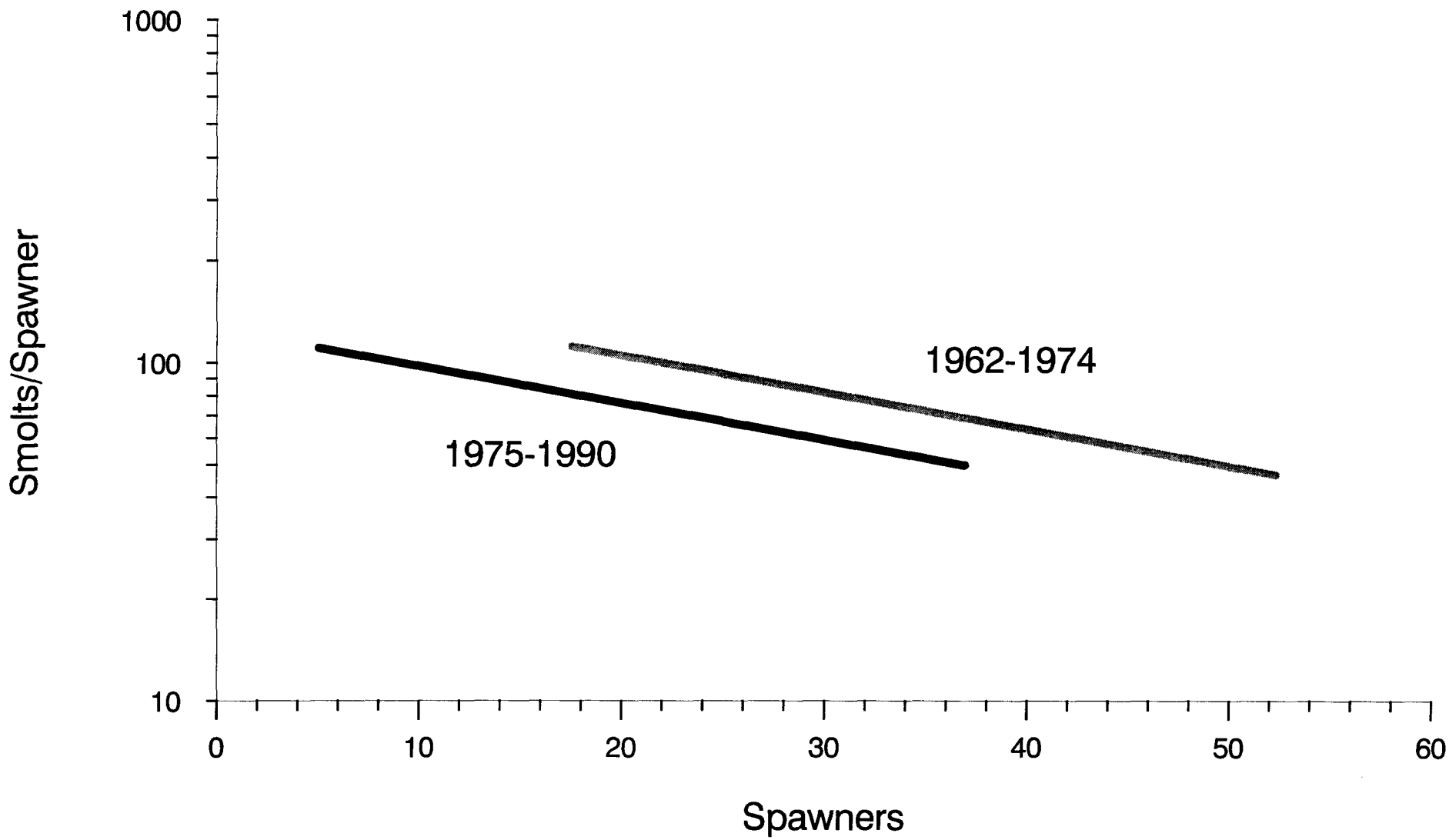

Figure 3. Smolt production relationships for Snake River spring-summer chinook: brood years 1975-90 compared to brood years 1962-74.

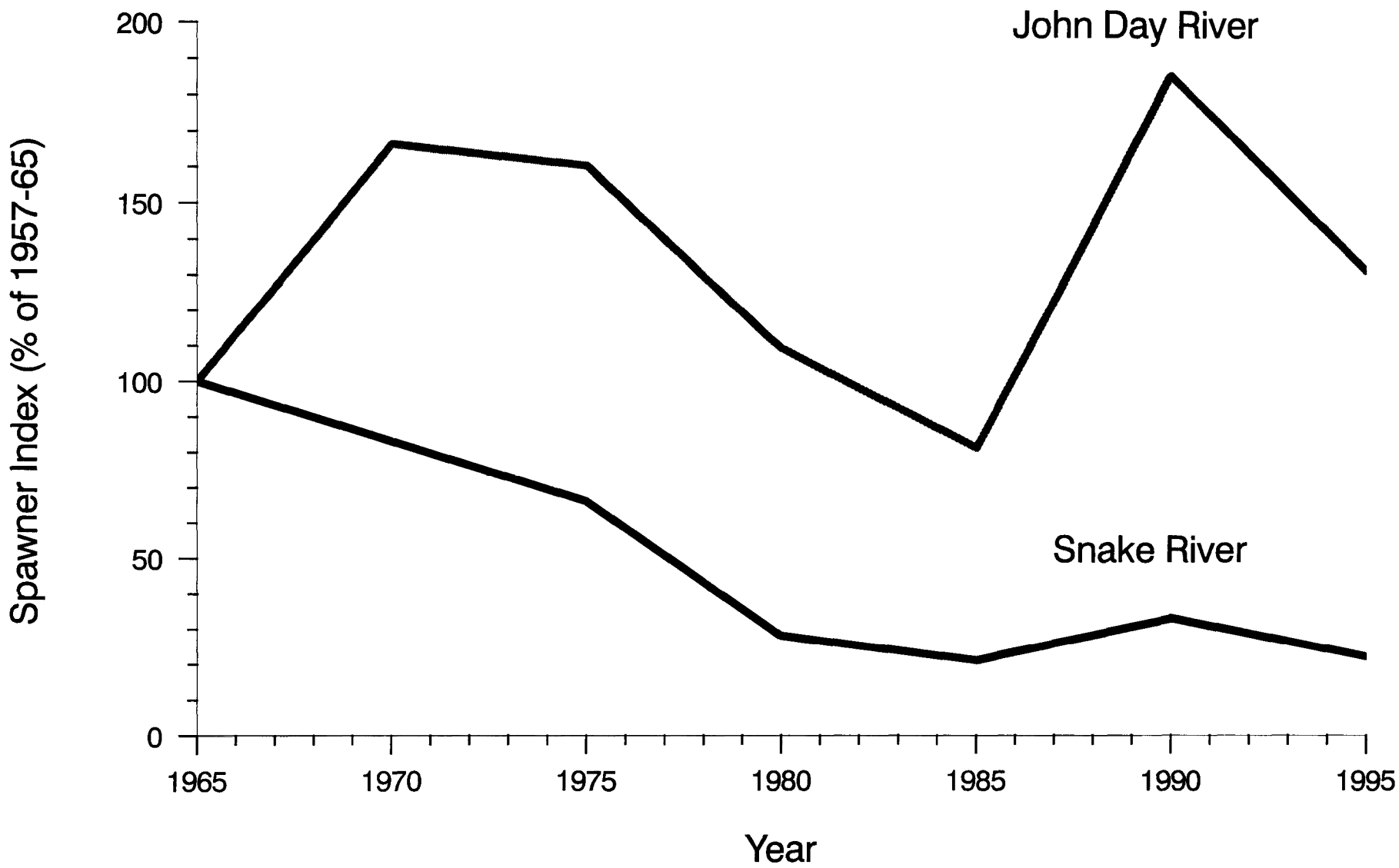

Figure 4. Abundance of spring chinook in the John Day and Snake rivers relative to the 1957-65 period.

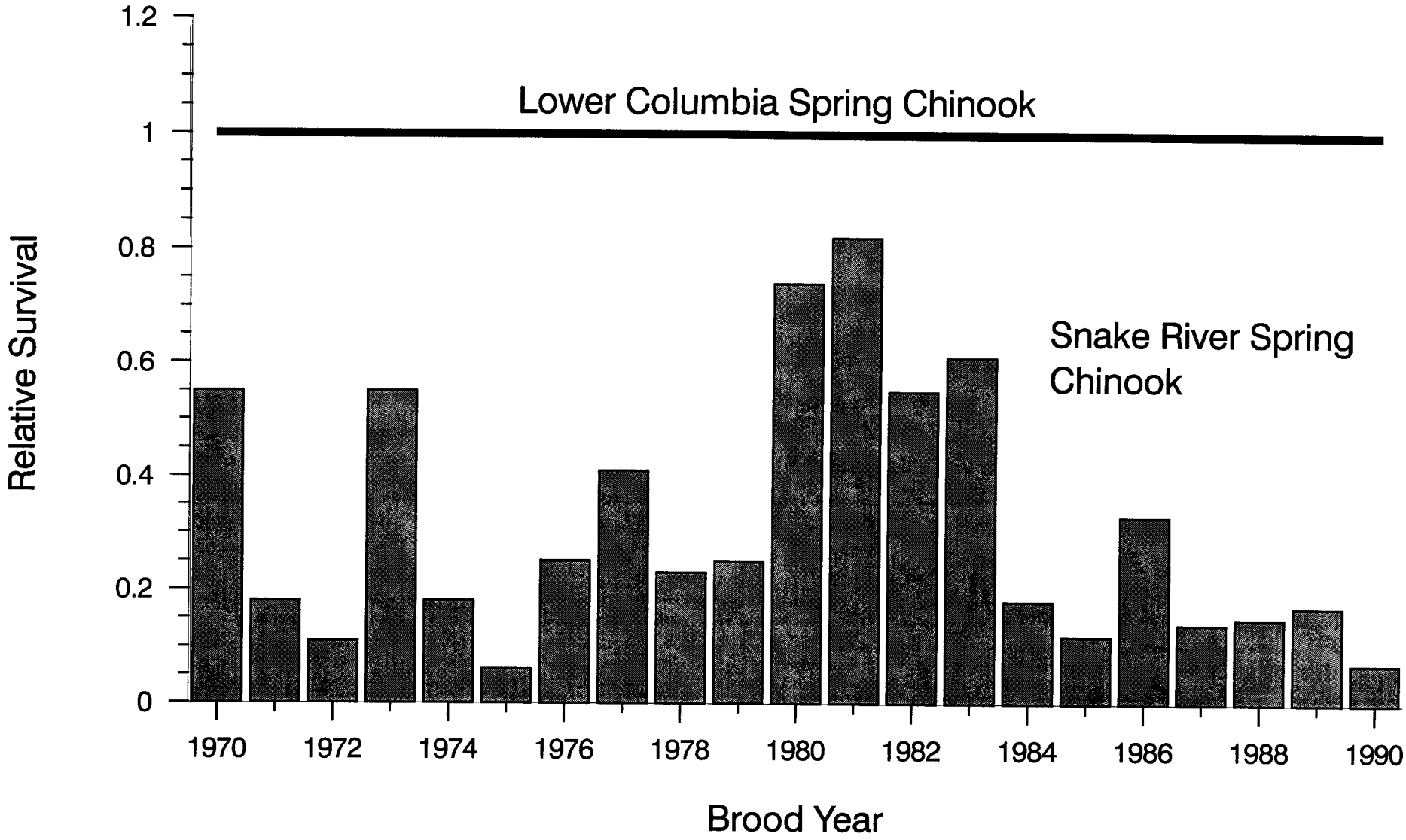

Figure 5. Survival of Snake River spring chinook relative to downriver stocks (lower Columbia River spring chinook) with similar life-histories. Survival of downriver stocks is standardized to 1.0.

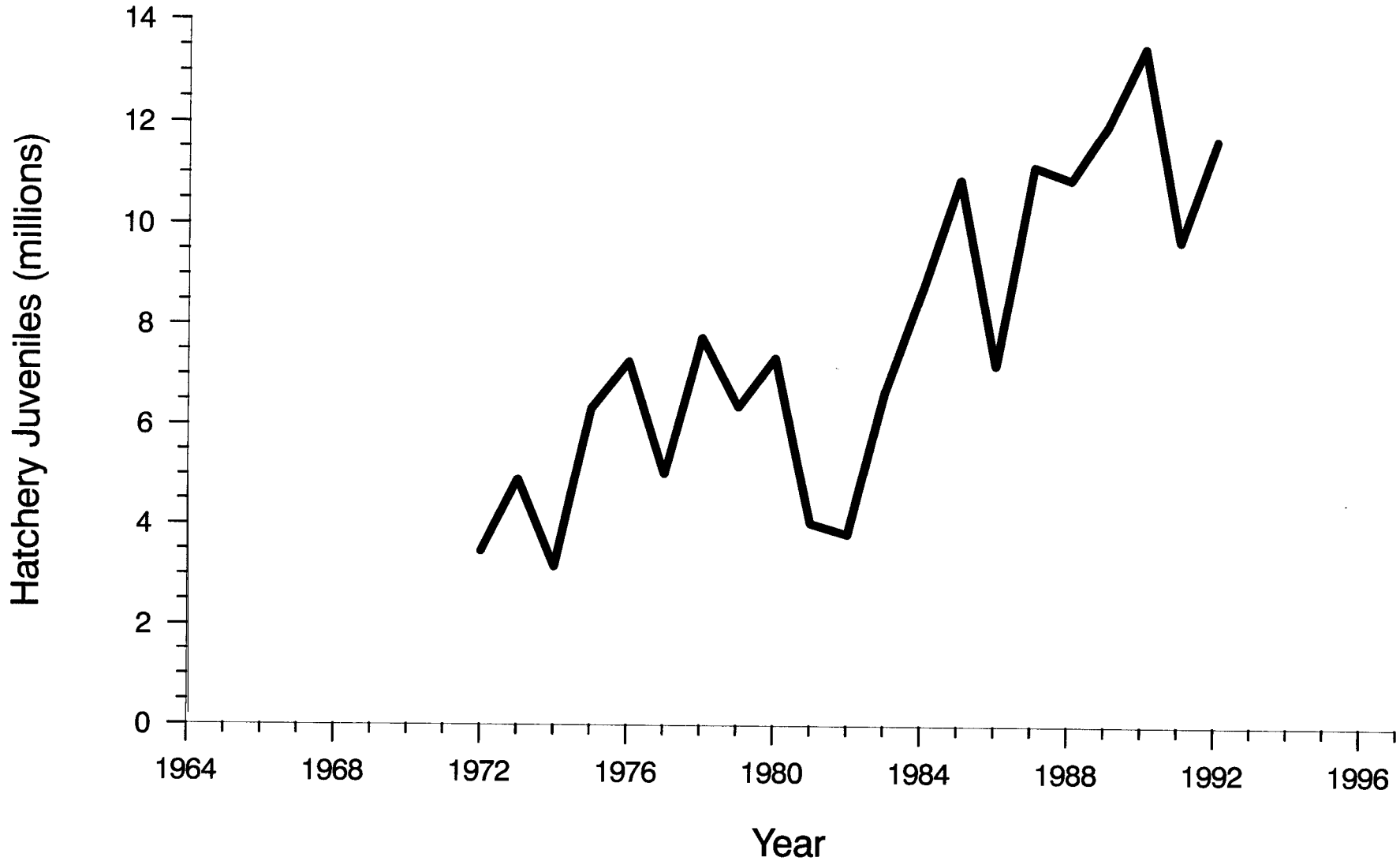

Figure 6. Releases of juvenile spring-summer chinook salmon from hatcheries in the Snake River Basin.

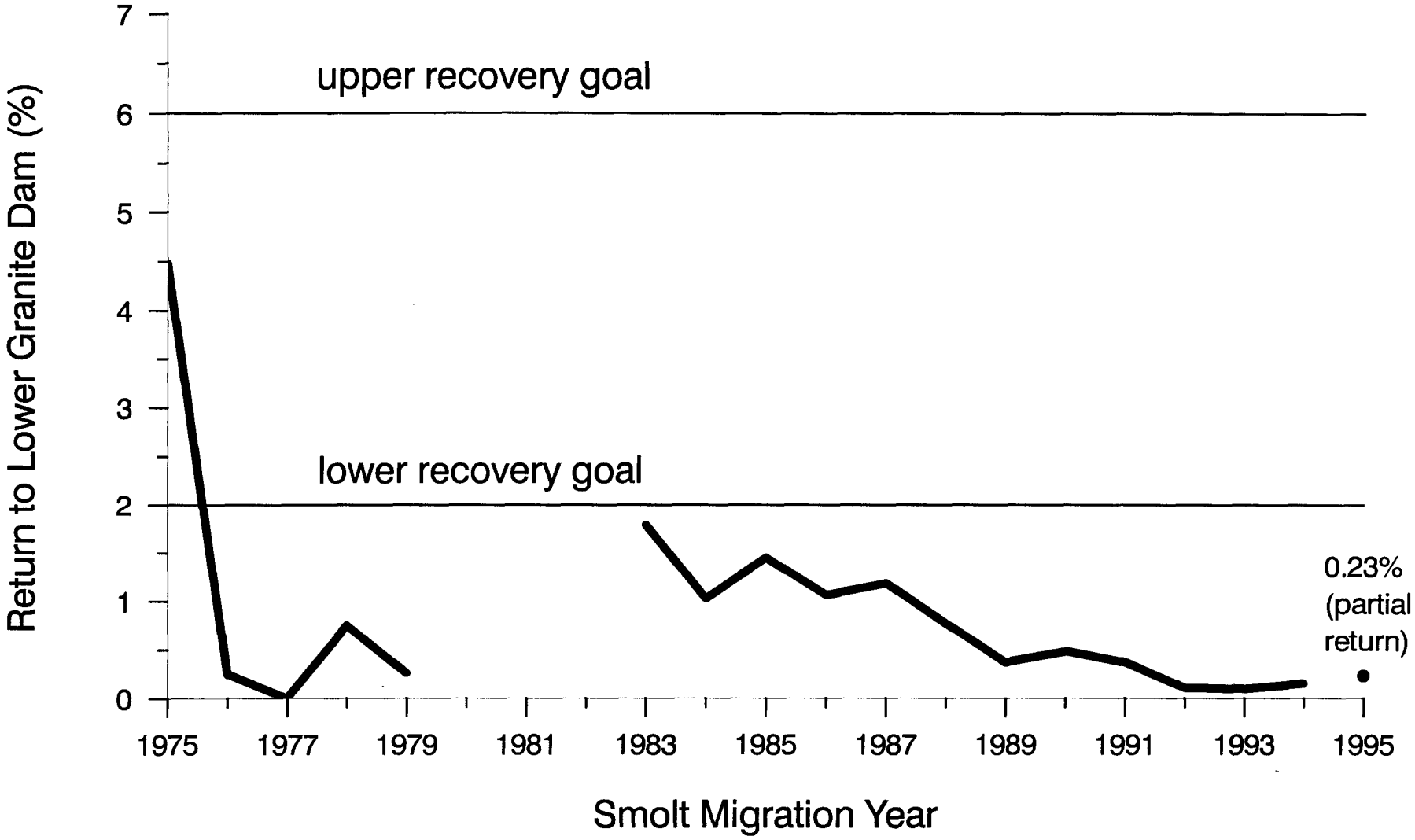

Figure 7. Smolt-to-adult survival of transported wild Snake River spring-summer chinook salmon. Data prior to 1988 based on coded wire tags; data from 1988-95 are from PIT tags.

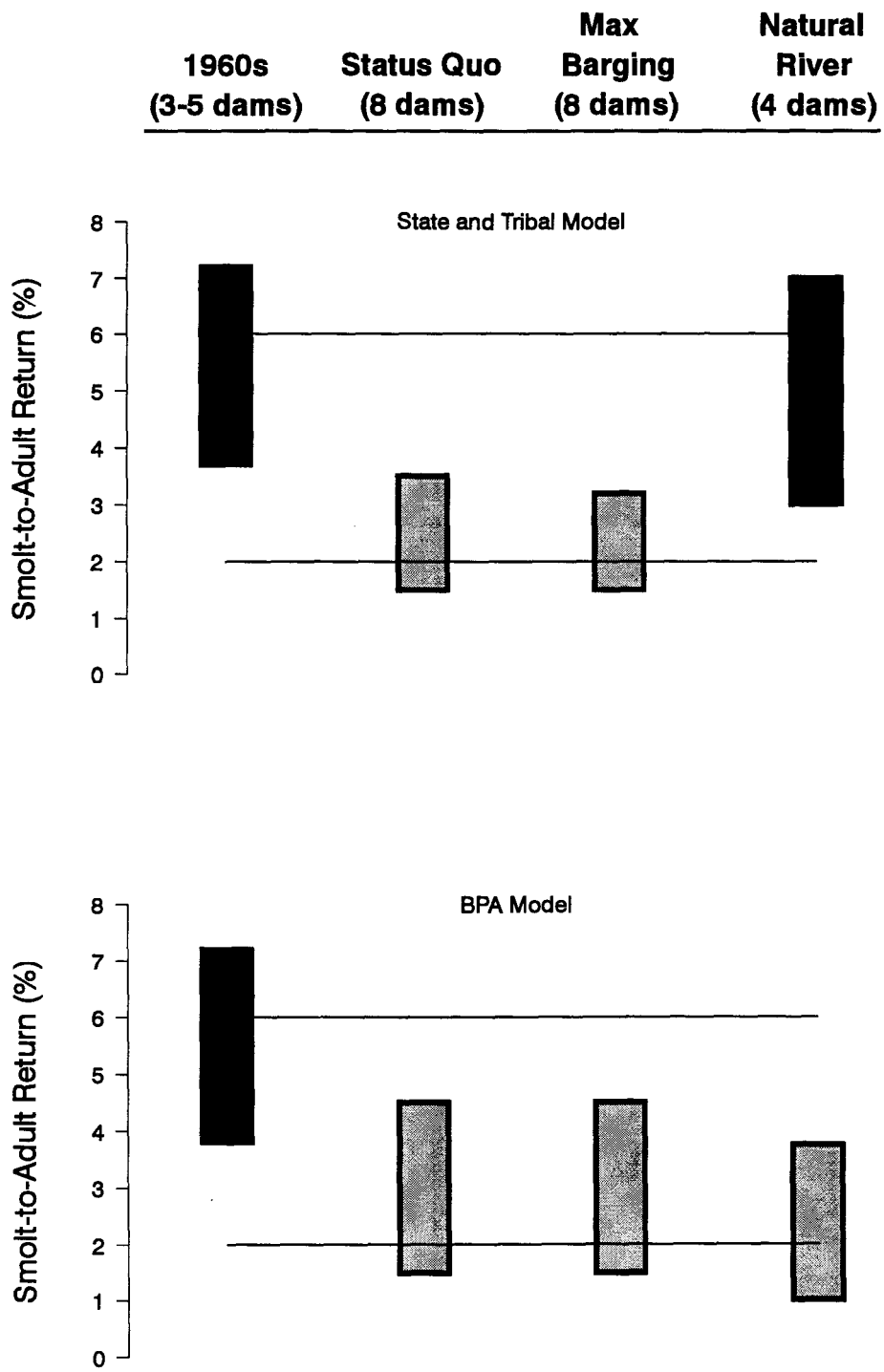

Figure 8. Smolt-to-adult return rates for wild Snake River spring-summer chinook compared to recovery thresholds. Results show historical estimates for the period prior to completion of the federal hydroelectric system, and model projections for three alternatives under consideration for the 1999 decision.

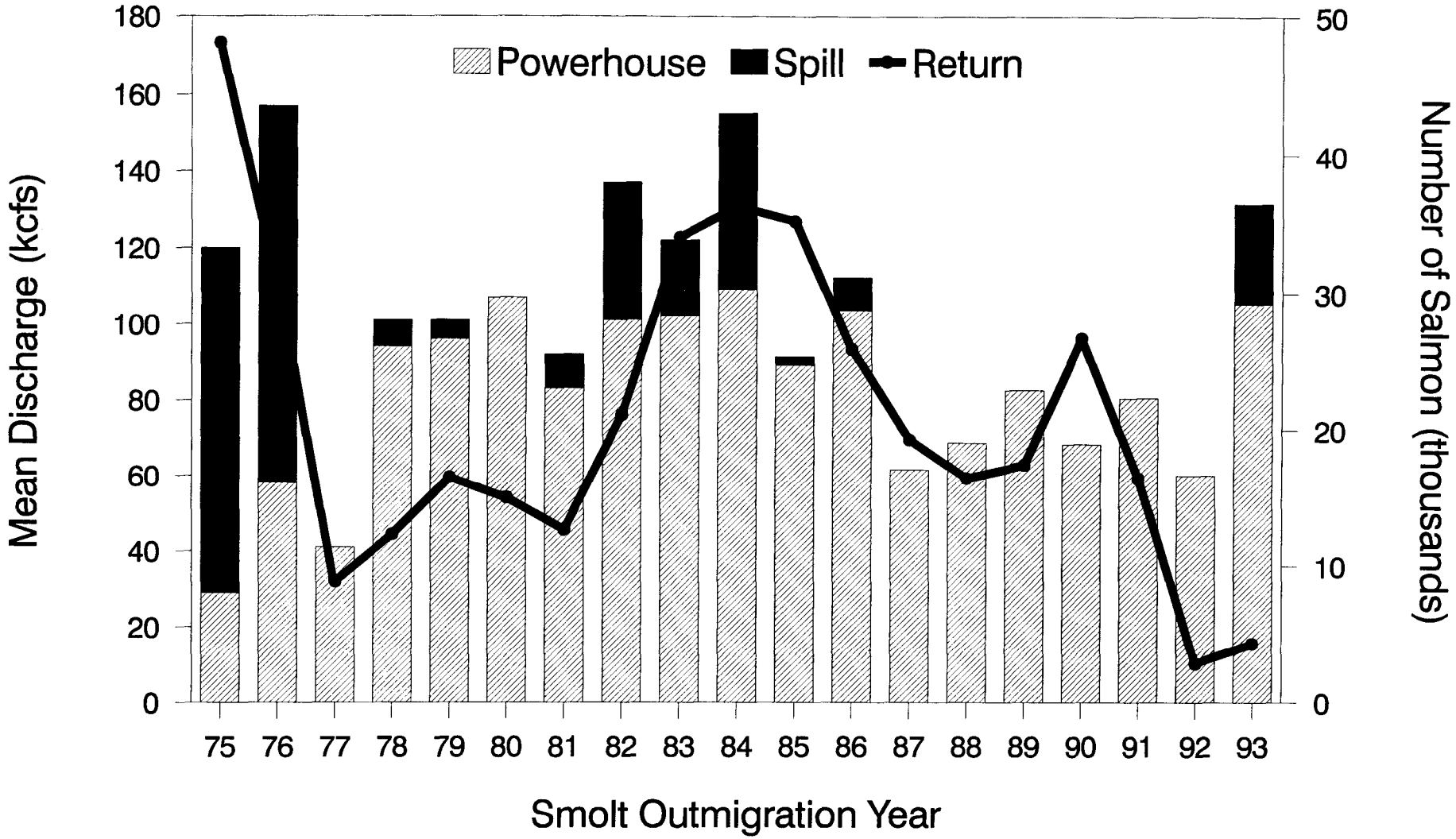

Figure 9. Flow and spill at Lower Granite Dam during May and subsequent returns of adult spring/summer chinook salmon to Lower Granite Dam.

State of Idaho
Department of Fish and Game
Boise, ID 83707

May 6, 1998

MEMORANDUM

TO: Steve Mealey, Director

FROM: Jerry Mallet,, Assistant Director

SUBJECT: Salmon and Steelhead Recovery Options

As per your request, this memo expands on the staff report *Idaho's Anadromous Fish Stocks: Their Status and Recovery Options* submitted May 1, 1998. The attached table is a qualitative assessment by Department staff of the relative risks and uncertainties of options considered for recovery. This assessment is based on the best available information at this time', and reflects the professional judgement of Department staff, myself included. As new information is gained, this assessment may change.

The first three options outlined in the table below are currently considered in the 1999 Decision Point process. The spillway crest option is not currently being considered. It was removed from consideration due to regional consensus that cost and biological uncertainty were too high.

Each of these four options include several operational variations, some of which are being analyzed by PATH (Plan for Analyzing and Testing Hypotheses) and DREW (Drawdown Regional Economics Workgroup). Department staff assessed the four options in a general sense recognizing the range of potential operations within each option.

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is assessment supports Department staff conclusions that the natural river option is the only option considered that can meet recovery standards, provide a high probability of delisting, and embrace a normative river.

Pending the 1999 Decision Point, Department staff do not recommend changing existing State and Commission interim migration policies. These include optimizing inriver migration conditions as best possible given existing constraints, and spreading the risk accordingly between

[1] Our assessment is based primarily on information discussed in the Department staff report *Idaho's Anadromous Fish Stocks: Their Status and Recovery*. This includes both internal Department analyzes and information from outside sources.

inriver and transported smolts based on river conditions (for more detail see State of Idaho comments, April 3, 1998, to NMFS on their 1998 Supplemental Biological Opinion). New PIT tag information anticipated in 1998 may shed additional light on transportation. Interim migration strategies should be reassessed and adjusted accordingly.

If the 1999 Decision Point is deferred or concludes that the natural river option is not socially acceptable, Department staff recommend reassessing alternative options that have less biological certainty and greater biological risk, consistent with the attached table. Based on our current assessment, this will likely include spillway crest drawdown with increased flow and dam passage improvements. Spillway crest drawdown as defined in footnote "d" on the attached table appears insufficient to provide recovery. Whatever the outcome of the 1999 Decision Point, the Department is committed to their continuing responsibility to "preserve, protect and perpetuate" salmon and steelhead for present and future Idahoans.

Please let me know if further clarification is needed.

Table 1. Qualitative assessment by Department (IDFG) staff of risks and uncertainties associated with several options considered for recovery. Information used in this assessment is primarily from the Department staff report *Idaho's Anadromous Fish Stocks: Their Status and Recovery Options.* Page numbers are provided to indicate some areas of the report that are pertinent to the assessment. Except for rows two and three, this assessment is based on the conclusion that smolt transportation has not compensated for mainstem hydrosystem development. Potential assessed values are: low, low-medium, medium, medium-high, high.

	Existing Transport and Flow Augmentation[a]	Improved Transport and Flow Augmentation[b]	Natural River[c]	Spillway Crest Drawdown[d]
Risk of Biological Failure[e]	High (p.13)	Medium-High (p.14)	Low (p.14, 16)	Medium (p.15-16)
Biological Risk if Wrong f Hypothesis	High (Fig. 8)	Medium-High (Fig. 8)	High (p.16, Fig.8)	High (p.15-16)
Risk-aversive Potential[s]	Low (Fig. 8)	Low-Medium (Fig. 8)	Medium-High (p. 16, Fig.8)	Low-Medium (p.15-16)
Biological Uncertainty[h]	Low (p.13, Fig.8)	Medium-High (p.13, p.16)	Low-Medium (p.14-16)	Medium-High (p.15-16)
Engineering Uncertainty[i]	Low (current oper.)	High (p.13-14)	Low-Medium (p.15)	High (p.15-16)
Probability of Recovery/ Delisting'	Low (Fig. 8, 11)	Low-Medium (Fig. 8, 11)	High (Fig. 8, 11)	Medium (p.15-16)
Consistency with "Normative" River[k]	Low (p.16-17)	Low-Medium (p.13,14,17)	High (p.14-17)	Medium (p.15-17)

[a] Mainstem spill, smolt transport, Dworshak and Brownlee drawdown plus 427 thousand-acre-feet flow augmentation from upper Snake River.

b Surface collectors, reduced spill, more barges, greater proportion of fish barged, Dworshak and Brownlee drawdown plus existing or 1-3 million-acre-feet additional flow augmentation from upper Snake River.

c Remove earthen portion of the four lower Snake River dams, John Day Dam left as is or reduced to spillway crest or natural river, existing flow augmentation or reduced to zero, no transportation.

d. Spring or spring/summer drawdown of lower Snake and John Day reservoirs to spillway crest, flow augmentation at existing or reduced levels, back-fill reservoirs in summer or fall with approximately 1 million acre-feet from Dworshak and Brownlee, mainstem spill, no transportation.

e Risk of failing to meet minimum biological needs of the fish (i.e., 2-6% smolt-to-adult survival) to provide sustainable recovery and consistent fisheries.

f Risk of failing to meet minimum biological needs of the fish if our assumed aggregate hypothesis (i.e., smolt transportation has not compensated for adverse effects of the dams) is wrong.

g Ability to minimize risk if the region is unable to decide which aggregate hypothesis is correct.

h Level of biological uncertainty associated with predicting the outcome of implementing the option.

i. Level of engineering uncertainty associated with developing technologies to implement the option.

j. Provide sustainable 2-6% smolt-to-adult survival.

k Provide "normative" river migration features as described by the Independent Scientific Advisory Board in their *Return to the River* document (e.g., historical water velocity and velocity gradients, turbidity, flow, temperature, resting habitat, feeding habitat, cover, etc.).

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