United States General Accounting Office

GAO

Report to Congressional Requesters

February 1993

ENDANGERED SPECIES

Potential Economic Costs of Further Protection for Columbia River Salmon

GAO/RCED-93-41

GAO

United States
General Accounting Office
Washington, D.C. 20548

Resources, Community, and
Economic Development Division

B-248261

February 23, 1993

The Honorable Bob Packwood
United States Senate

The Honorable Slade Gorton
United States Senate

Since 1981, federal agencies and regional organizations in the Pacific Northwest have reported taking numerous actions and spending over $1.3 billion (in 1991 dollars) to maintain and improve salmon runs in the Columbia River Basin.[1] However, the continuing decline of certain stocks of wild salmon,[2] especially those that spawn far upstream in the Snake River and its tributaries, has reached critically low levels.

In November 1991, the Department of Commerce's National Marine Fisheries Service (NMFS) listed the Snake River sockeye salmon as an endangered species under the Endangered Species Act. In April 1992, NMFS listed the Snake River fall chinook and spring/summer chinook as threatened species.[3] In accordance with the requirements of the act, NMFS is currently considering designation of the habitat that is critical to the survival of these salmon stocks and is developing plans for their recovery.

Concerned about the potential economic costs and effectiveness of future actions that may be taken to protect the listed salmon stocks, you asked us to identify and provide information on any available assessments of the likely economic impacts—particularly the possible loss of jobs—and on the potential effectiveness of measures being considered to protect these stocks. We previously reported on the historical costs incurred to protect all Columbia River Basin salmon stocks; this report examines some potential costs that may be incurred in the future on behalf of the listed salmon stocks.

Results in Brief

A preliminary estimate of the impacts of salmon protection measured in terms of potential jobs lost will not be available until mid-1993 at the

[1]See Endangered Species: Past Actions Taken to Assist Columbia River Salmon (GAO/RCED-92-173BR, July 13, 1992).

[2]Wild salmon are genetically unique populations that have maintained reproduction without supplementation from salmon hatcheries.

[3]An endangered species (which may also include a subspecies or a distinct population) is any species at risk of extinction in all or a significant portion of its range, whereas a threatened species is one that is likely to become endangered in the foreseeable future in all or a significant portion of its range.

earliest. However, preliminary estimates of the value of goods and services foregone—a measure of direct net economic costs—in the most current and comprehensive study completed to date of the likely economic costs of some potential salmon protection measures range from $2 million to $211 million annually (in 1990 dollars). This study primarily addressed streamflow measures designed to improve the survival of juvenile salmon, and it did not attempt to estimate how direct net economic costs may be distributed among various affected groups or within a specific region. The study showed that economic costs could vary significantly depending on the individual protection measures examined. More definitive estimates of economic costs cannot be determined until NMFS identifies the specific protection measures to be taken.

According to the more than 300 agencies and organizations we contacted, no studies address how effective any of the protection measures proposed to date might be in increasing the number of threatened and endangered adult salmon returning to spawn. Past evaluations of the effectiveness of measures taken to maintain and improve salmon runs either did not address the issue—or were inconclusive—from a Columbia River Basin-wide perspective.

Background

NMFS' consideration of listing three salmon stocks—one as endangered and two as threatened—under the Endangered Species Act raised much discussion and concern, particularly in the Pacific Northwest, over possible further actions that might be taken within the region or that might become elements of NMFS' salmon recovery plans. In addition, concerns were expressed about the possible costs of taking further salmon protection actions.

In considering whether to designate habitat critical to the survival of the three listed salmon stocks, NMFS examined the potential economic consequences of alternative designations of critical habitat. To assist in this endeavor, NMFS commissioned members of the University of Washington's School of Marine Affairs to prepare a study estimating the economic costs of selected potential salmon protection measures based on different critical habitat designations. To help focus the effort, NMFS asked the study team to limit its analysis to five sets of salmon protection measures that were under discussion in the Pacific Northwest region at the time. While several of the measures were more comprehensive in scope than the others, all five measures dealt with accelerating the springtime migration of juvenile fish to the ocean, particularly past the

Columbia River Basin dams, by altering or spilling the streamflow of the Columbia and Snake Rivers. The study team was not asked to evaluate the economic costs of other potential salmon protection measures, such as restricting salmon harvests, reducing the number of predator species, or enforcing existing harvest restrictions more vigorously.

In addition, the team's economic/technical committee determined that one of the five proposed streamflow measures, which was designed to increase the river flow targets at the Lower Granite Dam on the lower Snake River and at The Dalles Dam on the lower Columbia River, was not viable because historical data indicated that actual river flows would not, in most years, be high enough to meet the flow targets of the proposal. Consequently, this measure is not discussed in the following section of this report.[4] However, it is discussed in more detail, along with the other four measures, in appendix I. (App. II shows the location of the major dams along the Columbia River Basin.)

The study team began work in February 1992 and issued its final report, referred to as the Huppert report, in June 1992.[5]

Analyses of Salmon Protection Measures Show Wide Range in Possible Costs

The Huppert study reported that, from a national perspective, the potential direct net economic costs of undertaking selected salmon-protection measures that affect the streamflows of the Columbia and Snake rivers and that the study team considered technically feasible could range from $2 million to $211 million annually, depending on the measure selected. As defined in the study, the direct net economic costs are the value of goods and services foregone as a result of each protection measure, less any adjustments for offsetting values or reductions in costs that might also occur. However, according to the study's primary author, the study's estimates were preliminary and exploratory. The results of the Huppert study's analyses are shown in table 1.

[4]In commenting on a draft of this report, the Department of Commerce noted that this measure may be feasible if the federal agencies that produce and market hydroelectric power from Columbia River Basin dams agree to the release of additional water from behind the dams in the spring as part of their responsibilities to minimize harm to salmon stocks listed under the Endangered Species Act.

[5]Economic Effects of Management Measures Within the Range of Potential Critical Habitat for Snake River Endangered and Threatened Salmon Species, June 4, 1992.

Table 1: Estimated Direct Net Economic Costs of Some Salmon-Protection Measures as Identified in the Huppert Report

Millions of 1990 dollars

	Annual direct net economic costs estimated by Huppert report						
	Hydroelectric[b]						
Measure[a]	Replacement cost	Consumer surplus	Transportation	Recreation	Irrigation	Dam modifications	Total
Drawdown of the four lower Snake River reservoirs	$31-$114	$41-$97	$4.9-$6.5	$4.3-$8.6	$6.1-$8.1	$47-$91	$103.3-$211.2
Increased flow from upper Columbia and Snake rivers, and operation of four lower Snake River reservoirs and John Day reservoir at minimum operating levels[c]	$139-$159	$66-$112	$0	$2.7-$5.4[d]	$0.8-$6.1	$0	$69.5-$123.5
Drawdown of Lower Granite reservoir only	$(11)-$27[e]	$(4)-$23[e]	$2.5-$3.3	$3.2-$6.3	$2.5-$3.5	$12-$23	$16.2-$59.1
Increased water spillage over four dams	$2-$10	$2-$9	$0	$0	$0	$0	$2.0-$9.0

[a]One additional salmon protection measure, as discussed in appendix I, was judged not to be technically feasible by a NMFS economic/technical committee assisting the Huppert team. The estimated total annual direct net economic costs for this measure range from $153.0 million to $1,168.9 million.

[b]The report used two different methods to estimate the value of hydropower foregone—"replacement cost" and "consumer surplus." In replacement cost, lost hydropower is valued at the cost of replacing that power by the least costly alternative. In consumer surplus, the value of power foregone is estimated as the amount that the electricity consumer is willing to pay for the power minus the cost of supplying that power. While the replacement cost method is based on the assumption that the demand for power is fixed, the consumer surplus method assumes that the demand for power is related to its price and will change as price changes. The report calculated totals using the consumer surplus method.

[c]This measure was adopted in September 1992 and is currently being implemented.

[d]For John Day and Dworshak reservoirs. The report concluded that the measure would have a minimal, unspecified effect at Grand Coulee reservoir; because of an oversight it did not develop an estimate for Brownlee reservoir.

[e]Figures in parenthesis represent direct net economic benefits resulting primarily from (1) eliminating the designed release of water from upstream reservoirs in the spring to assist in juvenile salmon migration and (2) generating power with this water in the winter when it is more valuable.

Source: Daniel D. Huppert et al., Economic Effects of Management Measures Within the Range of Potential Critical Habitat for Snake River Endangered and Threatened Salmon Species, School of Marine Affairs, University of Washington (Seattle, Washington: June 4, 1992).

The common goal of all the measures examined in the Huppert study was to improve the survival rate of Snake River juvenile salmon in their downstream migration to the sea. This was to be accomplished by (1) drawing down reservoir levels or increasing water spillage over certain dams in the Columbia River Basin or (2) augmenting the existing flows in order to reduce the number of juvenile salmon killed when they pass through hydroelectric dams and to speed the springtime migration by partially restoring the annual spring runoff. In this regard, the measure to increase flows from the upper Columbia and Snake rivers by modifying spring river flows past a number of dams was included in the Pacific Northwest Electric Power and Conservation Planning Council's September 1992 amendments to its fish and wildlife program.[6]

The estimates of direct net economic costs associated with the four sets of viable salmon protection measures varied enormously: from $2 million to $9 million for the lowest cost measure and from $106 million to $211 million for the highest cost measure.[7] Reduced hydroelectric power generation at Columbia River Basin dams, along with associated dam modifications, accounted for the major share of the estimated economic costs for all the measures.

Officials from the U.S. Army Corps of Engineers, which operates nine federal dams on the Columbia and Snake rivers, stated that more refined cost estimates than those made in the Huppert report indicate that dam modification costs associated with drawing down the four lower Snake River reservoirs will be considerably higher than the Huppert estimates of $47 million to $91 million annually (which were based on a total cost estimate provided by the Corps of $1 billion). A further analysis completed by the Corps in November 1992 indicated that these total costs, to be spent over 14 to 17 years, could range from $1.3 billion to $4.9 billion. In addition, the Council, in commenting on a draft of this report, emphasized that costs can vary significantly depending on river flow conditions, as costs may be higher in low-water years. The Huppert report also qualified

[6]The Council is an interstate planning agency responsible under federal law for protecting, mitigating, and enhancing fish and wildlife, specifically fish and wildlife affected by the Columbia River Basin power-generating facilities.

[7]Using data provided by the U.S. Department of Agriculture's Forest Service, the study team also estimated, on the basis of the critical habitat alternatives it studied, the annual direct net economic costs resulting from the impacts that livestock grazing, recreation, timber harvesting, and minerals production had on Forest Service lands. The study estimated that, for all habitat designation alternatives and for each of the four viable streamflow measures, the annual cost would be $15 million. The Department of the Interior's Bureau of Land Management, which is also responsible for managing extensive expanses of federal lands, did not provide the study team with the necessary data to make a similar estimate of the economic costs of potential critical habitat designations on its lands.

its estimates by noting that other options the report did not consider, such as electricity exchanges with the Southwest, could lessen the overall hydropower costs to the Northwest.

In addition, using assumptions different from those in the Huppert report could also alter the estimated range of costs. For example, the Department of Energy's Bonneville Power Administration (BPA), which markets electric power produced at federally operated dams in the Columbia River Basin, estimated that the direct net economic costs in hydroelectric power to draw down the four lower Snake River reservoirs will range from $47 million to $122 million annually, compared with the Huppert study's estimates of $31 million to $114 million. The different estimates resulted from different assumptions on how long the reservoirs will be drawn down and how likely power generation will continue during the drawdown.

Different Perspectives on Estimates of Economic Costs

In its analysis of proposed salmon protection measures, the Huppert study team focused on estimating the net direct economic costs to the nation—that is, the value of goods and services foregone as a result of each measure, less adjustments for any offsetting values or reductions in costs that might also result from implementing the measure.[8] For example, using water to speed fish migration to the sea rather than using it to irrigate crops would reduce farm income (the value of goods foregone) but could potentially increase hydropower revenues (an offsetting value). A net direct economic costs analysis considers both of these factors in determining a net economic effect.

The net direct economic costs included in the Huppert report represent the dollar value of goods and services foregone in sectors directly affected by the protection measures, such as hydroelectric power, irrigated agriculture, navigation and transportation, recreation, and land use. However, the study did not measure direct economic costs in terms of potential jobs lost, nor did it examine any short-term secondary "spillover" economic effects that may occur. Corp officials told us the Corps is working with an economic consulting firm to develop estimates of secondary economic cost data and job losses. However, preliminary estimates will not be available until mid-1993, and a final report is not planned until 1994.

[8]The value of goods and services foregone is estimated by comparing the value with the protection measure with a baseline scenario representing economic conditions without the protection measure.

The Huppert study generally assessed economic costs from the perspective of the entire nation; it did not examine how the costs and offsetting benefits may be distributed across various affected groups or within a specific region.[9] However, some regional entities did furnish us with estimates of these specific regional impacts, which were not fully reflected in the Huppert study's national costs. For example, the state of Montana informed us that disruptions in barge traffic caused by altering the streamflows of the Columbia and Snake rivers could raise the annual shipping costs of the state's grain growers by as much as $9.2 million per year. Furthermore, Montana asserted that lost sales or reduced prices stemming from lost barging on the Snake River could add another $4.4 million annually. However, while this foregone transportation value would be a cost to barge companies and grain shippers in the state of Montana, it could be a benefit to others in the Northwest such as railroads. These costs and benefits could cancel each other out in an analysis of the net direct economic costs to the nation.

Some Pacific Northwest regional organizations reported cost estimates to us that differed from those in the Huppert study. For example, the Huppert report indicated that the Corps determined that the measures included in the Council's Fish and Wildlife Program will not affect recreation at reservoirs in Montana. But according to information provided by the state of Montana, because of lower water levels in the reservoirs, the measures might have first-year costs as high as $2.6 million, with an additional $2.1 million in secondary job-related impacts.

In addition, some regional organizations expressed concern about the economic effects of losing barge transportation under two of the streamflow measures evaluated in the Huppert report. The Oregon Wheat Growers League, the Montana Wheat and Barley Committee, and the Washington Association of Wheat Growers expressed concern about the potential loss of foreign markets because of higher costs to supply the market. However, these organizations did not provide specific cost estimates.

Cost Estimates for Other Measures Are Limited

With few exceptions, information on the estimated economic costs of protecting salmon through measures other than changing streamflows was unavailable. An organization that represents irrigators, the Northwest Irrigation Utilities, reported to us that it had studied the net direct

[9]While the Huppert study attempted to estimate economic costs regardless of where they might occur, the study recognized that its electricity cost estimates did not fully capture costs in regions other than the Pacific Northwest.

economic costs associated with restrictions on harvesting salmon. This organization's study estimated that reducing the in-river harvest by 30 percent would have a net economic cost to commercial fisheries of $4.8 million a year and that eliminating the in-river harvest entirely would increase the cost to $16.3 million annually. The study reported that some resource managers may take the position that fishermen should be compensated for permanent harvest restrictions. The study estimated that compensating commercial fishermen for the loss of their commercial fishing licenses would involve a one-time buyout cost of $41 million to $82 million.

The Effectiveness of the Various Protection Measures Is Uncertain

While some believe that the streamflow measures presented in the Huppert report will provide substantial benefits to the salmon stocks listed under the Endangered Species Act, there are no scientific estimates of the degree of success these measures will have. Neither the Huppert report nor any of the more than 300 agencies and organizations we contacted identified any scientific studies that address the degree to which any of the proposed protection measures might increase the number of threatened or endangered adult salmon returning to spawn. While the Huppert report briefly addressed two computer models that help estimate the potential effectiveness of salmon protection measures, the report stated that it was not possible to determine the effectiveness of the streamflow measures it examined because of the lack of certainty about how the actions proposed might affect salmon survival. BPA officials advised us that they will have to implement the measures before they can obtain data to determine biological effectiveness. Moreover, as we reported in July 1992, past evaluations of the effectiveness of actions taken to maintain and improve salmon runs either did not address the issue—or were inconclusive—from a Columbia River Basin-wide perspective.

However, the Council, in commenting on a draft of this report, stated that its salmon-protection program confronts the need for immediate action in the face of scientific uncertainty by applying what it describes as the principle of adaptive management. The Council stated that it seeks to improve its knowledge through adaptive management by viewing salmon-protection measures as vehicles for learning. According to the Council, the measures, even if they fail, should provide useful information for future salmon-protection actions.

Agency Comments

The Office of Assistant Secretary for Administration, Department of Commerce; the Office of the Assistant Secretary, Department of the Army; the Pacific Northwest Electric Power and Conservation Planning Council;[10] and BPA provided written comments on a draft of this report (see app. III-VI). The Council and the Department of Commerce briefly elaborated on selected topics discussed in the draft report, and the Department of the Army concurred with the information in the draft report without providing any specific comments. BPA provided more extensive comments, including specific suggestions for some language changes in the report. BPA's concerns dealt primarily with our discussion of the Huppert study, which BPA pointed out contains limitations in scope and methodology. BPA was concerned that, among other things, the Huppert study (1) examined the costs of proposed salmon-protection measures but not their potential effectiveness, (2) focused mainly on improving the downstream passage of juvenile salmon without evaluating the full range of potential actions for salmon recovery, and (3) did not distinguish between more readily available short-term measures and long-term measures that would take more time to implement. We agree that the Huppert study has limitations, and our report notes that the study's primary author regarded the study's cost estimates as preliminary and exploratory. We have incorporated the agencies' comments where appropriate and have also discussed BPA's comments in more detail in appendix VI.

We conducted our review between March and December 1992 in accordance with generally accepted government auditing standards. In conducting our review, we contacted more than 300 agencies and organizations to obtain information about the costs and effectiveness of measures being proposed or being considered for protecting Columbia River Basin salmon that are listed as endangered or threatened (see app. VII).

Unless you publicly announce its contents earlier, we plan no distribution of this report until 30 days from the date of this letter. At that time, we will make copies available to the Secretary of Commerce; the Secretary of Defense; the Administrator, Bonneville Power Administration; the Chairman, Pacific Northwest Electric Power and Conservation Planning Council; and other interested parties. Copies will also be made available to others on request.

[10]On its letterhead, the Council's name is shortened to the Northwest Power Planning Council.

Please contact me on (202) 275-7756 if you or your staff have any questions. Other major contributors to this report are listed in appendix VIII.

James Duffus III
Director, Natural Resources
Management Issues

Contents

Abbreviations

BPA	Bonneville Power Administration
GAO	General Accounting Office
NMFS	National Marine Fisheries Service

Salmon-Protection Measures Discussed in the Huppert Report

Using input from National Marine Fisheries Service (NMFS) officials, the authors of the Huppert report addressed five measures aimed at drawing down reservoir levels, augmenting river flows, or increasing water spillage over certain dams in the Columbia River Basin. The common goal of all five was to improve the survival rate of Snake River juvenile salmon in their downstream migration to the sea by (1) reducing the mortality rate during passage through hydroelectric dams and (2) speeding up their trip by partially restoring the annual spring runoff. The five measures, explained in more detail below, are as follows:

- A state of Idaho proposal to draw down reservoir levels behind the four lower Snake River dams during the spring.
- A set of measures to increase flows on the Columbia and Snake rivers by modifying river flows past a number of dams in the spring. These proposals have been adopted by the Pacific Northwest Electric Power and Conservation Planning Council.
- A proposal to draw down one lower Snake River reservoir—the Lower Granite—during the spring.
- A NMFS proposal to spill additional water over four Columbia River Basin dams.
- A proposal to increase minimum river flows at Lower Granite Dam on the lower Snake River and at The Dalles dam on the lower Columbia River.

State of Idaho Proposal to Draw Down Reservoir Levels Behind Four Dams

The goal of this state of Idaho proposal is to increase the velocity of river flows in the lower Snake River for 2 months in the spring to help juvenile salmon migrate downstream. Under the measure, this would be accomplished by reducing the reservoir levels behind the four lower Snake River dams—Lower Granite, Little Goose, Lower Monumental, and Ice Harbor. Since the planned water levels are below what the dams were originally designed for (minimum operating level), this measure would require structural modifications to the dams to allow the passage of both juvenile and adult salmon.

Pacific Northwest Electric Power and Conservation Planning Council Measures to Modify Spring River Flows Past a Number of Dams

In September 1992 the Council, an interstate planning agency whose responsibilities under federal law include enhancing, mitigating, and protecting fish and wildlife affected by Columbia River Basin power-generating facilities, adopted certain amendments to its fish and wildlife program that called for a number of changes in the operations of Columbia River Basin dams and reservoirs during the spring in order to enhance salmon survival. Among the changes to increase flows contained in the proposed amendments were the following:

- Drawing down the reservoirs behind four dams on the lower Snake River, and behind the John Day reservoir on the Columbia River, to their minimum operating levels.
- Releasing water stored in the upper Snake River to augment flows in the middle and lower Snake River.
- Releasing additional water from the Grand Coulee Dam on the upper Columbia River.

In addition, the Council, in commenting on a draft of this report, stated that its plan includes the state of Idaho's draw-down proposal—contingent on further study to assess its biological and economic feasibility—as a long-term measure.

Proposal to Draw Down the Reservoir Level at Lower Granite Dam

This proposal is to draw down the reservoir level in the spring only at Lower Granite Dam, the dam furthest upstream of the four lower Snake River dams. The measure would require structural modifications only at Lower Granite, but it would also involve greater efforts to collect juvenile salmon at Lower Granite and physically transport them downstream to the Columbia River below Bonneville Dam, the last dam on the Columbia River before the Pacific Ocean.

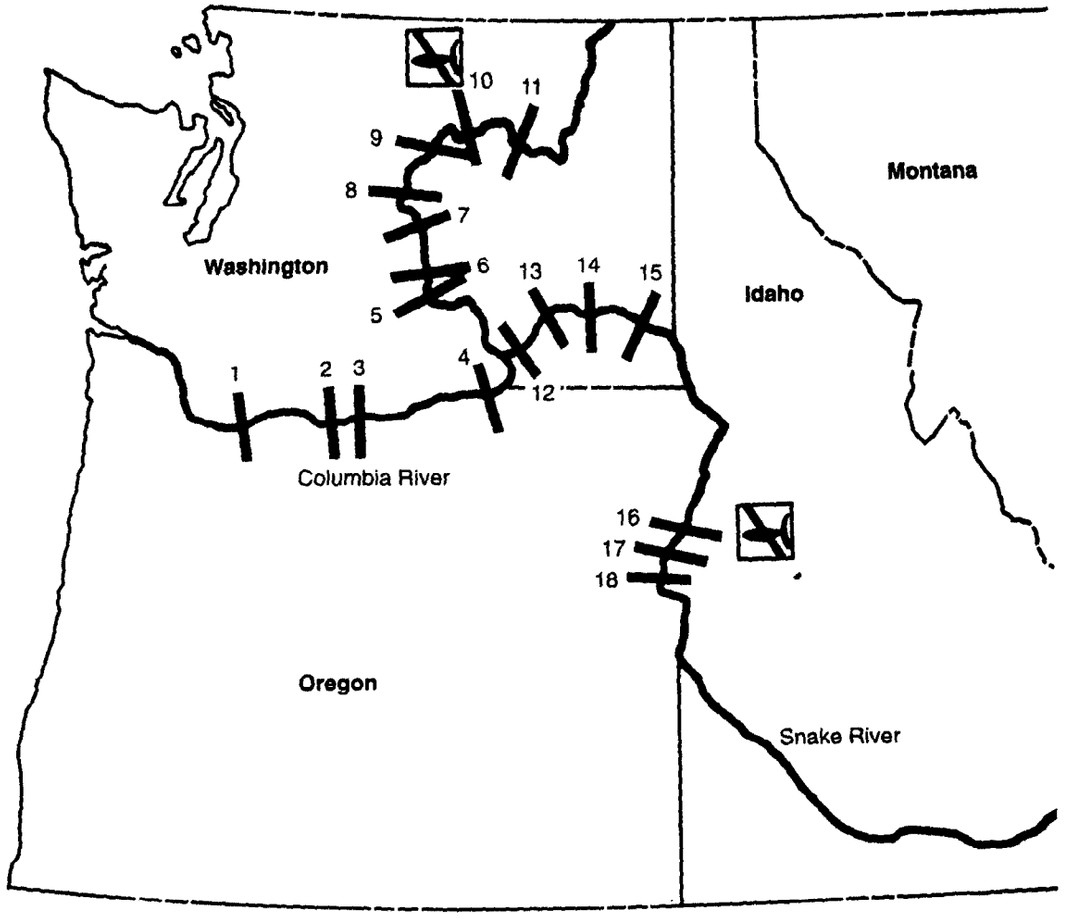
NMFS' Proposal to Spill Water Over Four Dams

This proposal involves spilling additional amounts of water over four dams to help prevent juvenile salmon from being directed through the hydroelectric turbines. The current operating plan for the Columbia River Basin dams calls for planned spills at the Lower Monumental, Ice Harbor, John Day, and The Dalles dams for this purpose. The NMFS proposal suggests three additional spills of 10, 25, and 50 percent above current levels.

Proposal to Increase River Flows

This is a proposal for raising minimum river flows to 85,000 cubic feet per second on the lower Snake River at Lower Granite Dam and to 200,000 cubic feet per second on the lower Columbia River at The Dalles Dam during specified months of the spring by releasing additional water from upstream dams. In December 1991, NMFS submitted this measure to an economic/technical committee NMFS established to assist the Huppert study team. The committee found that water flows would not, in most cases, be high enough to meet the flow targets established in the measure. The committee's report concluded that the measure was not viable. The report said withdrawal of irrigation water from the upper Snake River may have been the reason why the natural runoff did not support the flow targets.

Major Dams on the Columbia and Snake Rivers



1. Bonneville
2. The Dalles
3. John Day
4. McNary
5. Priest Rapids
6. Wanapum
7. Rock Island
8. Rocky Reach
9. Wells
10. Chief Joseph
11. Grand Coulee
12. Ice Harbor
13. Lower Monumental
14. Little Goose
15. Lower Granite
16. Hells Canyon
17. Oxbow
18. Brownlee

Fish cannot migrate past dams at these points.

Source: Status Report: Columbia River Fish Runs & Fisheries, 1960-90, Oregon Department of Fish and Wildlife and Washington Department of Fisheries.

Comments From the Pacific Northwest Electric Power and Conservation Planning Council

NORTHWEST POWER PLANNING COUNCIL
851 S.W. SIXTH AVENUE, SUITE 1100
PORTLAND, OREGON 97204-1337

Phone: 503-222-5161
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November 30, 1992

James Duffus, III
Director, Natural Resources Management Issues
Resources, Community, and Economic Development Division
United States General Accounting Office
Washington, D.C. 20548

Dear Mr. Duffus:

Thank you for the opportunity to comment on the draft report Endangered Species: Potential Economic Costs of Further Protection for Columbia River Salmon. Because the report primarily examines the study performed for the National Marine Fisheries Service by Dr. Daniel Huppert, these comments address only the references to the Northwest Power Planning Council's Strategy for Salmon.

The Council adopted Phase three of the strategy in September as the report was being prepared. Phase three incorporated the flow measures adopted in December 1991, and referenced in the draft report, but the September 1992 rulemaking is the appropriate cite for the Council's plan.

In the discussion of the potential costs of river operation proposals, the report should include water conditions as a significant variable, not just the particular configuration of individual measures. For example, the net impact of flow actions in most water years is about $35 million. In low water years, however, the costs could be significantly higher. The average cost, including the cost of lost capacity and flexibility, is estimated to be $40 to $70 million over all water years.

The report correctly finds uncertainty for the effectiveness of salmon rebuilding proposals. The Council confronts the need for immediate action in the face of scientific uncertainty by encouraging the use of the principle of adaptive management. Adaptive management is a scientific policy that seeks to improve management of biological resources by viewing program actions as vehicles for learning. Our program stresses designing salmon rebuilding

actions so that, even if they fail, useful information is provided for future actions. In this way, we hope to improve understanding of the effectiveness of measures as we initiate action to rebuild threatened and endangered species.

The summary of flow proposals in Appendix 1 distinguishes the Idaho drawdown proposal from the Council's flow augmentation measures. The Council plan includes the drawdown plan as a long-term measure unless it is found to be biologically imprudent or economically unfeasible. A drawdown planning committee is at work to evaluate how structural modifications could be made to permit drawdown of the four lower Snake River reservoirs.

Again, we appreciate the opportunity to provide comments.

Sincerely,

Edward W. Sheets

Edward W. Sheets
Executive Director

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Comments From the Department of the Army

DEPARTMENT OF THE ARMY
OFFICE OF THE ASSISTANT SECRETARY
WASHINGTON, DC 20310-0108

30 NOV 1992

REPLY TO
ATTENTION OF

Mr. James Duffus III
Director, Natural Resources
Management Issues
Resources, Community, and Economic
Development Division
U.S. General Accounting Office
Washington, D.C. 20548

Dear Mr. Duffus:

This is the Department of Defense (DoD) response to the General Accounting Office (GAO) draft report, "ENDANGERED SPECIES: Potential Economic Costs of Further Protection for Columbia River Salmon," dated October 29, 1992 (GAO Code 140672/OSD Case 9151-A).

The DoD has reviewed the draft report and concurs without further comment. The Department appreciates the opportunity to review the report in draft form.

Sincerely,

Nancy P. Dorn
Assistant Secretary of the Army
(Civil Works)

Comments From the Department of Commerce

UNITED STATES DEPARTMENT OF COMMERCE
Chief Financial Officer
Assistant Secretary for Administration
Washington, D.C. 20230

8 DEC 1992

Mr. James Duffus, III
Director, Natural Resources
Management Issues
U.S. General Accounting Office
Washington, D.C. 20548

Dear Mr. Duffus:

Thank you for your letter requesting comments on the draft report entitled, "Endangered Species: Potential Economic Costs of Further Protection for Columbia River Salmon."

We have reviewed the enclosed comments of the Deputy Under Secretary for Oceans and Atmosphere and believe they are responsive to the matters discussed in the report.

Sincerely,

Preston Moore

Enclosure

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
Washington, D.C. 20230
OFFICE OF THE COMPTROLLER

NOV 27 1992

Mr. James Duffus III
Director, Natural Resources
Management Issues
Resources, Community and Economic
Development Division
U.S. General Accounting Office
Washington, D.C. 20548

Dear Mr. Duffus:

Thank you for your letter requesting the Department of Commerce's comments on the draft General Accounting Office report entitled "Endangered Species: Potential Economic Costs of Further Protection for Columbia River Salmon" (GAO/RCED-93-41).

Our only area of concern deals with the exclusion of the National Marine Fisheries Service proposal for increased river flows (alternative 2 in the enclosed Huppert report). The exclusion was based on information provided by the Economics Committee that indicated this option could not be met in most cases. However, this option may be feasible through augmentation by a spring water budget pledged by the Federal hydropower agencies in the section 7 process.

We appreciate this opportunity to comment on the draft report.

Sincerely,

Ray Kammer

Enclosure

Comments From the Bonneville Power Administration

Department of Energy
Bonneville Power Administration
P.O. Box 3621
Portland, Oregon 97208-3621

In reply refer to: PJI

DEC 11 1992

Mr. James Duffus, III
Director, Natural Resources Management Issues
United States General Accounting Office
Resources, Community and Economic Development Division
Washington, DC 20548

Dear Mr. Duffus:

Your letter of October 29, 1992 requested review and comment on the General Accounting Office (GAO) draft report Endangered Species: Potential Economic Costs of Further Protection for Columbia River Salmon (GAO/RCED-93-41). The following comments cover Bonneville Power Administration's (BPA) major comments on with this draft report. Specific text and editorial changes based on these comments are suggested for your consideration in Enclosure A.

Analyzing economic costs of regional recovery measures for salmon protection is an important and difficult task. GAO is to be commended for attempting to identify the economic impacts to the nation and the region of salmon recovery measures under the Endangered Species Act (ESA).

Use of the Huppert Report

See comment 1.

The GAO report relies heavily on an analysis provided by Huppert, et al.[1], for the National Marine Fisheries Service (NMFS). This report has some significant limitations, and, when used as a basis for analyses of future costs associated with salmon recovery, may underestimate the true cost of endangered species recovery. These limitations include:

- With one minor exception (Appendix I), the Huppert report lists costs, but does not analyze cost effectiveness. The authors of the report were not asked to review or analyze the biological effectiveness of alternative measures. Without understanding a measure's biological effectiveness, legitimate cost comparisons cannot be made. For example, two measures of equal cost may have extraordinarily different biological impacts, and without further biological research the region cannot quantify and compare those impacts.

[1]Huppert, Dan, David Fluharty, and Elizabeth Kenny. Economic Effects of Management Measures Within the Range of Potential Critical Habitat for Snake River Endangered and Threatened Salmon Species. June 4, 1992. Report prepared for the National Marine Fisheries Service.

See comment 2.

- The Huppert Report is limited in scope. It focused on improving juvenile passage by means of revising hydro-operations. It does not evaluate the full range of potential actions for salmon recovery. ***We believe a complete recovery analysis must include cost effectiveness and biological effectiveness information in all areas related to the salmon stocks' life cycle. This includes effectiveness information in the areas of juvenile and adult passage, harvest, habitat, and hatchery use, as well as hydropower operations.***

Now on p. 4.

Relying on Huppert options (Table 1, page 6) for the economic basis of your report may give a false impression of the number and range of alternatives being considered in the region. The Huppert report does not evaluate the costs or biological effectiveness of many juvenile and adult recovery measures, harvest, research, or habitat measures.

Cost and effectiveness information was included in your publication Endangered Species: Past Actions Taken to Assist Columbia River Salmon (GAO/RCED-92-173BR). This followup report should provide the same breadth and depth of analysis of recovery measures for ESA listed species.

See comment 3.

- Recently, the U.S Army Corps of Engineers (Corps) released preliminary costs of dam modifications to accomplish drawdown proposals[2]. In their report, the costs associated with design and construction only range from $1.3 to $4.9 billion over a 14 to 17 year schedule . These estimates do not include power costs or other costs, such as mitigation, associated with drawdown options. The costs are considerably higher than those included in the Huppert report. Using Huppert's preliminary costs in Table 1 (page 6) underestimates the cost of dam modification and may mislead readers to the true cost impacts of drawdown measures.

Now on p. 4.

See comment 4.

- The Huppert Report analyzed economic costs from a national perspective for a number of activities, but the power results were based on regional estimates of the value for nonfirm and capacity. This makes the statement of "national perspective" incorrect as presented on pages four, and nine through eleven, of the GAO draft.

See comment 5.

- There is no distinction between long-term and short-term measures or actions, which is a critical factor in economic and biological analyses. It is difficult to compare measures that require significantly different lead times to implement. For example, river operations can be modified relatively quickly to implement flow augmentation measures . In other cases, it may take 14 to 17 years to modify Lower Snake River Federal dams to implement drawdown measures[2].

[2] Columbia River Salmon Mitigation Analysis System Configuration Study, Phase I Activities. Interim Status Report. US Army Corps of Engineers. November, 1992.

Additional concerns with use of the Huppert report are illustrated in a September 17, 1992, letter to the NMFS by the Pacific Northwest Utilities Conference Committee (PNUCC). We have enclosed this letter for your reference.

See comments 1 and 2.

Recovery Plan Costs

The NMFS has not completed its recovery plan for the salmon species petitioned under the ESA. To allude to a cost range of $2--$211 million for salmon protection is somewhat misleading in the context used. This cost range, as mentioned previously, does not include the full range of recovery measures or costs associated with a comprehensive recovery plan which includes habitat, harvest, and hatchery measures. As you have noted, more definitive estimates of economic costs must wait until NMFS completes its recovery planning process.

See comment 6.

Comparing Alternatives

We are concerned with the way alternative measures were compared in several parts of the GAO draft document. We believe it is important to understand that measures evaluated the Huppert Report are not directly comparable to measures addressed in the GAO inquiry.

Now on p. 4.

Some of the drawdown actions outlined in Table 1, page 6 of the GAO draft, such as increased flow from upper Columbia and Snake Rivers, lower Snake River drawdown and John Day Reservoir drawdown were more complete proposals than others presented in the table. Proposal four, increased spill over four dams, is a minor action compared with the more extensive proposals shown.

At best, comparability is difficult when equally effective measures are considered. In Table 1, an attempt has been made to compare proposals with vastly different biological and economic effectiveness. It must be noted that cost effectiveness of each proposal has not been addressed, due primarily to a lack of biological data. Until this analysis is done, the comparisons have limited value. Also, valid recovery plan comparisons must focus on all areas of life-cycle improvements--harvest, habitat, hatchery and passage improvements--not just hydropower system operation.

See comment 6.

Biological Effectiveness Language

You have drafted and included a key sentence concerning the importance of biological effectiveness: "Without knowing the potential effectiveness of the various salmon protection actions proposed, the economic costs of the proposed actions cannot be weighed against the potential benefits to the species." As mentioned above, comparing economic costs of recovery measures is irrelevant unless biological effectiveness of the measures is determined.

Deleted sentence.

BPA is concerned that the full impact of this sentence will be lost by virtue of its placement on page 13, at the end of the report. We would appreciate inclusion of a stronger statement, early in the report text.

See comment 7.

BPA's Fish and Wildlife Investment

The original request from GAO for information concerning salmon recovery measures included over 100 different measures to be analyzed. While it may be true that cost estimates for proposals other than those analyzed by Huppert are limited, it does not mean that they do not exist.

BPA responded to your initial request for information with specific dollar amounts for more than 40 recovery measures. These include:

1. Measures for the benefit of juvenile passage including spill, predation control, and acquiring energy options which are estimated to cost at least $60 million per year. Another juvenile passage measure, screening of projects, is estimated to cost $50 million;

2. Habitat measures (including hatchery and supplementation) which are estimated to increase costs by up to $10 million per year;

3. Some harvest measures (law enforcement and public education) which are estimated to cost $10 million over 3 years;

4. Research measures--including construction of PIT tag facilities and a complete review of potential operations of the Northwest's hydro-thermal power system--which are estimated to cost at least $35 million, with some additional annual costs; and

5. Monitoring and evaluation of recovery measures are also likely to result in significant annual costs.

BPA is responsible for significant annual fish and wildlife investments. Fiscal Year (FY) 1993 annual investments are estimated to be $280 million, growing to an estimated average of $295 million per year by FYs 1994 and 1995. This substantial annual cost to BPA's ratepayers includes: BPA's direct fish and wildlife program, power purchases for fish enhancement, and foregone revenues associated with spill. Additionally, the $295 million includes BPA repayment to the US Treasury for annual operation and maintenance costs and interest expense on the Corps and Bureau of Reclamation hydroproject fish and wildlife investments assigned to power.

These annual BPA costs include an approximate $100 million per year for costs associated with ESA activities. These costs do not reflect the investments in reconfiguration of the Corps dams on the Snake River to meet drawdown proposals that are presently under study by the Corps.

In closing, we appreciate your consideration of these comments. Quantifying costs and benefits associated with a regional recovery effort is a complex and difficult task. We hope these comments will clarify BPA concerns. If you have any questions, please do not hesitate to call Peggy Olds, (503) 230-5209, for additional information.

Sincerely,

Walter E. Pollock
Assistant Administrator for
Power Sales

2 Enclosures:
Comments for Text
PNUCC Letter to NMFS

cc:
Mr. E. Woodruff, U.S. Army Corps of Engineers
Ms. S. MacReynolds, Pacific Northwest Utilities Conference Committee
Mr. D. Faulkner, Direct Service Industries, Inc.
Mr. R. Brange, U.S. Bureau of Reclamation

ENCLOSURE 1

Specific text recommendations and detailed comments raised by BPA on the GAO draft report:

Now on p. 2.
See comment 8.

Page 1:
Results in brief section, line 6-- ". . . economic costs of salmon protection done to date range from $2 million to $211 million . . . ." The $2 million figure was an estimated cost of a single spill element. It was never considered a stand-alone option or comprehensive study of economic costs. The cost range, as presented, implies to the reader the region could buy a "protection package" for as little as $2 million or as much as $211, and either package would "protect" salmon with equal effectiveness.

> Recommendation: After "protection" add the word ***"actions."*** Then add the following sentences: ***"Some of these actions were intended to be complete plans for recovery, while others were only minor actions which would constitute a small portion of a complete recovery plan. In addition to the limited number of hydropower-related actions studied, there were a number of other actions proposed in the region, but not analyzed by Huppert."***

Now on p. 3.
See comment 9.

Page 4:
Sentence three: After the word "altering" insert the words ***"or spilling."***

Now on p. 3.
See comment 8.

Sentence four: Alter the sentence to read: ***"Of the five actions analyzed, the action to increase river flow targets . . ."***

See comment 4.
Now on p. 3.

Last paragraph: The Huppert report apparently analyzed economic costs from a national perspective for a number of activities, but the power results were based on regional estimates of value for nonfirm and capacity, so the statement of national perspective is incorrect for these two items. The nonfirm and capacity costs probably would have been significantly higher if it was valued at what it was worth to California, as opposed to what the Pacific northwest gets paid for it. This is also stated incorrectly on pages 9 through 11.

Now on p. 4.
See comment 8.

Page 6, Table 1:
Title--Change the title to read:

> ***"Estimated Direct Net Economic Costs of Some Salmon Protection Actions Identified in the Huppert Report."***

See comment 10.

Proposal column--Drawdown in this table is used to mean two completely different operations. In the second action listed, substitute:

> ***"Increased flow from upper Columbia and Snake rivers, operate at minimum operating pool on four lower Snake River reservoirs, and John Day reservoir.***

See comment 11.

Footnote "e"-- Substitute the following wording:

> ***"Figures in parenthesis represent direct net economic benefits resulting primarily from eliminating water budget and generating power with the water in the winter when it is more valuable."***

Now on p. 5.
See comment 8.

Page 7
Last sentence: change the word "proposal(s)" to ***"action(s)"*** in three places of this sentence.

Now on p. 6.
See comment 12.

Page 8
Last paragraph: Delete "10". There are 30 major federally-owned and operated dams in the Columbia River Basin.

Now on pp. 6-8.
See comment 4.

Pages 9-11
In several places throughout this text GAO refers to ". . . direct net economic costs to the nation . . . ." Power results were based on regional estimates of the value for nonfirm and capacity. Text references to "national" should be revised to note that power results are regional estimates.

Now on p. 8.
See comment 7.

Page 11
Cost Estimates for Other Proposals--We recommend the insertion of the following language under this heading:

> ***"Many of the measures analyzed were for the benefit of juvenile passage. BPA evaluated a broad range of measures with respect to their impact on power. Measures for the benefit of juvenile passage including spill, predation control, and acquiring energy options are estimated to cost at least $60 million per year. In addition, the cost of screening projects is estimated to be $50 million.***
>
> ***Some adult harvest measures (law enforcement and public education) were addressed by the Bonneville Power Administration as part of the Council's Fish and Wildlife Program. These measures are estimated at $10 million (direct costs) over three years.***

Habitat measures (including hatchery and supplementation) are estimated to increase costs by up to $10 million per year.

The costs of research measures have been estimated to be at least $35 million, with some additional costs each year. Research measures include construction of PIT tag facilities and a complete review of potential operations of the Northwest's hydro-thermal power system. Monitoring and evaluation of recovery measures is also likely to result in significant annual costs."

Now on p. 8.
See comment 13.

Page 12
Paragraph 2 line 6. Technically, this is an incorrect statement as written. The Huppert Report does include estimates of the effectiveness in improving survival for several different actions on ts he last page of the report. Although it is a decidedly limited analysis of costs and effectiveness, it is inaccurate to state there is no scientific evidence estimating the degree of success these measures will have. The smolt-to-adult returns is one measure of biological effectiveness developed for population models, as noted in your report on page A-2.

Now on p. 14.
See comment 6.

Page 16
Of the five actions presented here, only two, the Council Plan Phase II and the NMFS minimum flows, were ever presented as being complete plans, and even in these two, the costs of all actions, other than revised hydropower operations, has been ignored. Other actions, which should be considered, include predator control, funding basic research, funding screening for irrigation diversions, and increased law enforcement efforts.

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The following are GAO's comments on Bonneville Power Administration's letter dated December 11, 1992.

GAO Comments

1.We agree that the Huppert study contains limitations in its scope and methodology, as we have noted in our report that the study's primary author regarded the study's cost estimates to be preliminary and exploratory. We also state that neither the Huppert study nor any of the more than 300 agencies and organizations we contacted identified any scientific studies addressing the degree to which any of the actions proposed might increase the number of threatened or endangered adult salmon returning to spawn.

2.We recognize in our report that the goal of all the Huppert study salmon-protection measures was to improve the survival rate of juvenile salmon on their downstream migration to the sea, and we also state that, with few exceptions, information on the estimated economic costs of protecting salmon through measures other than changing streamflows was unavailable.

3.We have revised our report to recognize the Corps of Engineers' more recent cost estimates.

4.We have revised our report to recognize that while the Huppert study attempted to estimate economic costs regardless of where they might occur, the study realized that its electricity cost estimates did not fully capture costs in regions other than the Pacific Northwest.

5.We agree that the Huppert report's discussion of potential salmon protection measures did not make any distinction between long-term and short-term actions.

6.The purpose of our work was to identify and comment on estimates of costs associated with, and the potential biological effectiveness of, measures to further protect the threatened and endangered salmon stocks. We did not make, nor did we intend to make, any comparison of the different options either in terms of their cost or cost effectiveness. NMFS will determine what actions it believes are needed for an appropriate recovery plan for the listed salmon.

With regard to the sentence quoted from our draft report, we believe the sentence could be viewed as suggesting that a cost/benefit assessment of

salmon recovery would or should be a component of recovery planning. Under the Endangered Species Act, Section 4 (f), recovery actions are to be identified which may be necessary to achieve the recovery plan's goal for the conservation and survival of the species. The plan is also to incorporate estimates of the time required and cost to carry out the needed actions. Since a cost/benefit assessment is not a requirement for recovery planning, we have deleted this sentence from our final report.

7.As we noted in our previous report,[1] BPA's fish and wildlife program has incurred hundreds of millions of dollars in salmon-related costs since enactment of the Pacific Northwest Electric Power Planning and Conservation Act in 1980. BPA's written comments indicate its continuing commitment to salmon protection activities in the future. However, we did not incorporate into our report the estimated future costs reported by BPA because we could not readily distinguish the portion of these costs attributable to the threatened and endangered salmon stocks versus all other salmon stocks in the Columbia River Basin.

8.BPA is concerned that our characterization of the salmon protection measures as "proposals" is too broad a term, and BPA recommends that "actions" be substituted. The Huppert study generally uses the term "measures" throughout, and we have modified our report to be consistent with the Huppert study's terminology.

9.We agree and have made the appropriate change.

10.We agree and have made the appropriate change.

11.We agree and have made the appropriate change.

12.We agree and have made the appropriate change.

13.We have clarified the sentence in question to read that scientific information has yet to be developed relating to the effectiveness of salmon-protection measures. The Huppert study briefly discusses two theoretical computer models that are used to help estimate the potential effectiveness of salmon-protection measures.

[1]Endangered Species: Past Actions Taken to Assist Columbia River Salmon (GAO/RCED-92-173BR, July 13, 1992).

Scope and Methodology

To obtain information on the potential economic costs of salmon-recovery proposals, we contacted government agencies and other organizations in the Pacific Northwest to identify any analyses that they have done or that they are currently conducting. These agencies and organizations included the following:

- Federal agencies responsible for (1) managing salmon stocks, spawning areas, and migratory routes; (2) operating the dams on the Columbia and Snake rivers; and (3) marketing electric power from the dams.
- State fish and wildlife agencies.
- Public and private utilities.
- Indian tribes and tribal organizations.
- Major timber companies.
- Grain growing or marketing organizations.
- Environmental groups.

We selected these agencies and organizations because of their known or potential involvement in efforts to maintain or restore salmon runs, or their known or potential reliance on the Columbia River Basin system along with the possibility that changes in this system could affect them. In addition, we obtained the reports of interagency groups formed specifically to estimate these potential economic costs. Overall, we contacted more than 300 agencies and organizations.

In analyzing the responses received, we examined the important assumptions used, and in cases where we found significantly different assumptions, we contacted the organizations responsible for preparing the estimates to determine the reasons for the differences. We obtained the services of a private economics consultant, Walter R. Butcher of Washington State University, to help us review the information we received.

Our audit work was conducted between March and December 1992 in accordance with generally accepted government auditing standards. We obtained written comments on a draft of this report from the major agencies and organizations from which we received information, including the Bonneville Power Administration, the National Marine Fisheries Service, the U.S. Army Corps of Engineers, and the Pacific Northwest Electric Power and Conservation Planning Council. We have included their comments where appropriate.

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