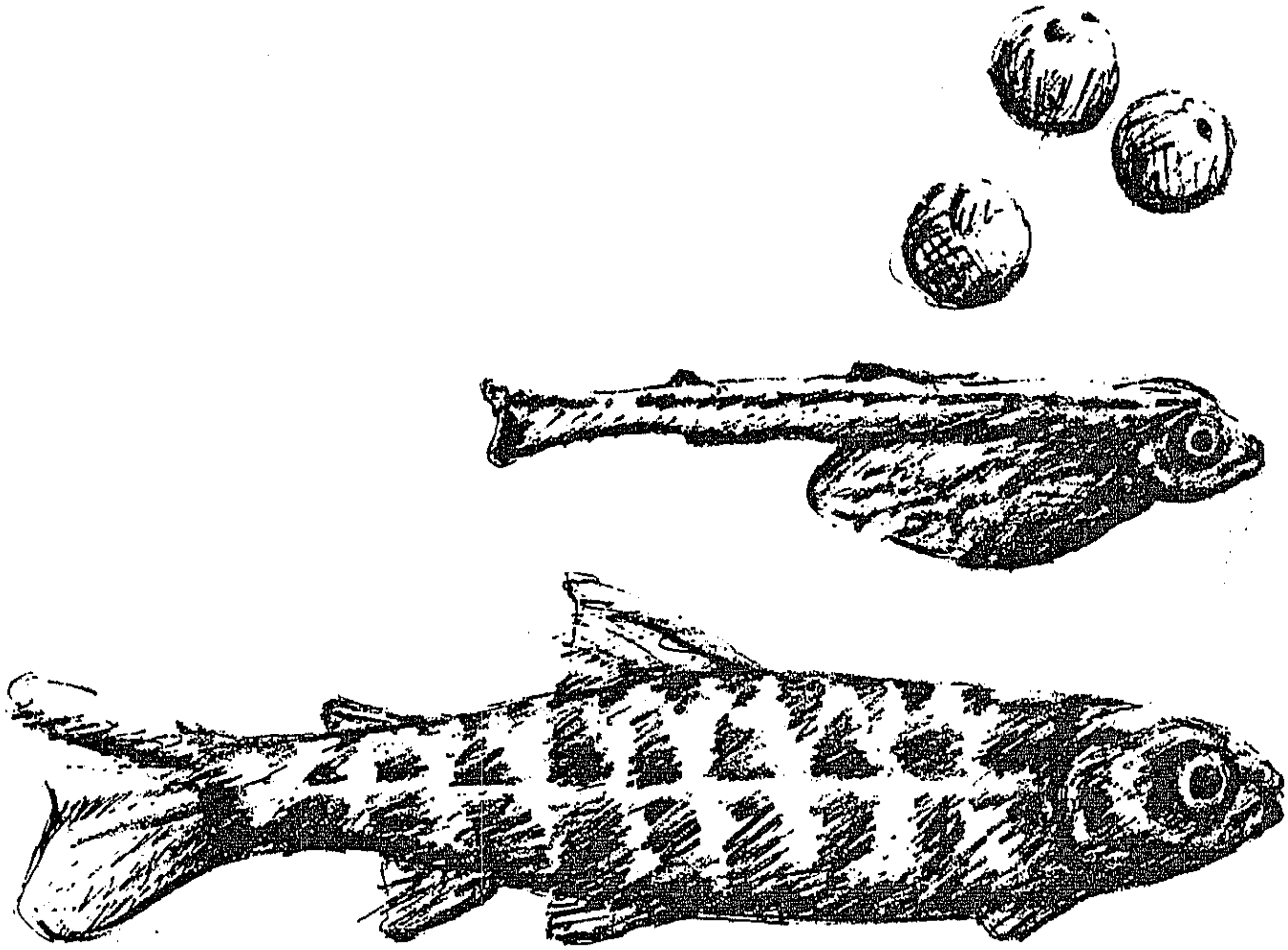
1982 Annual Report

Committee on Fishery Operations



Columbia River
Water Management Group

March 1983

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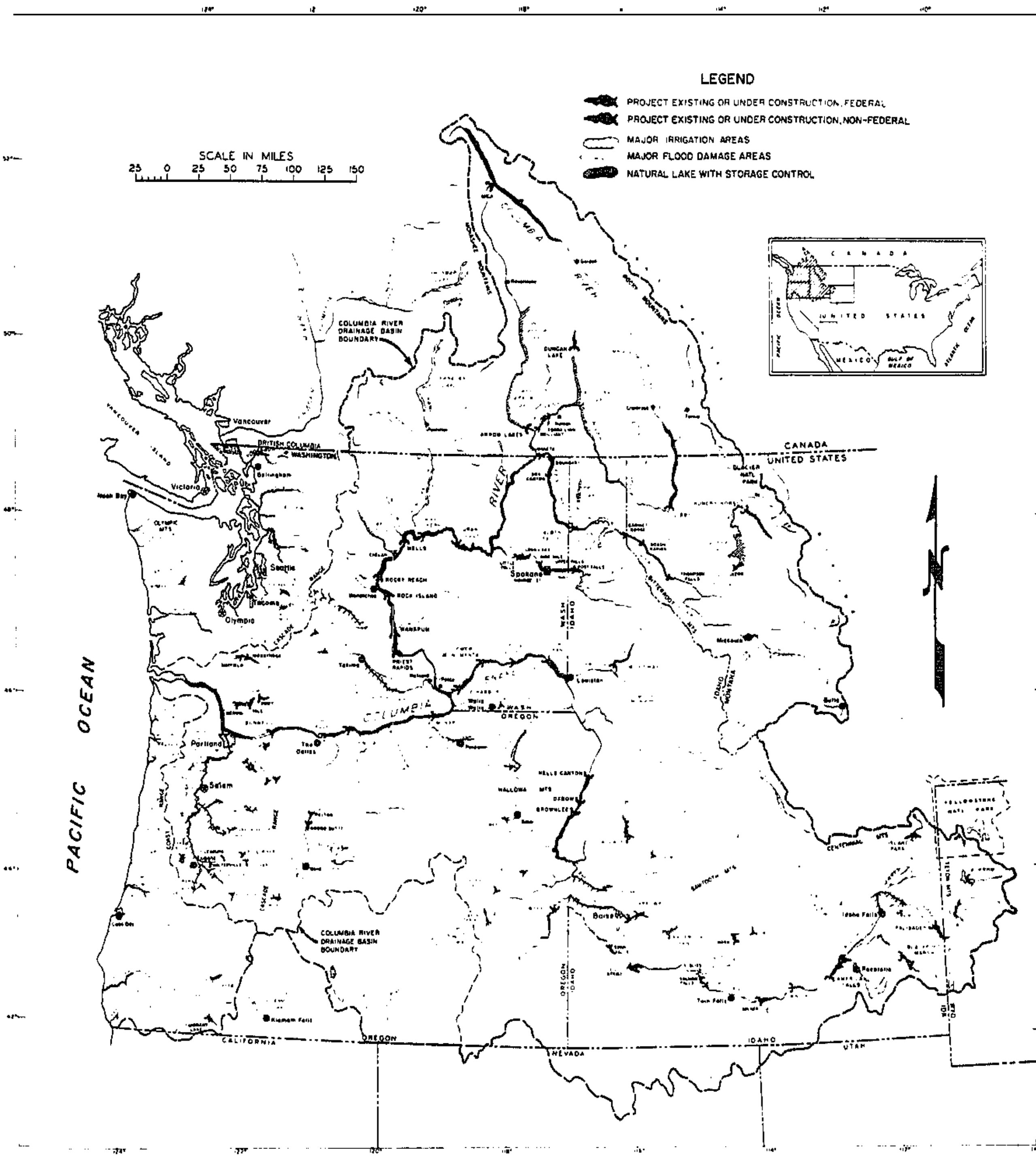


FOREWORD

The Committee on Fishery Operations (COFO) composed of both fishery management agency members and energy/water agency members, was formed in 1975 under the aegis of the Columbia River Water Management Group (CRWMG). The Committee has issued an Annual Report describing special efforts to manage energy and stream flow to improve survival of migrating salmon and steelhead since 1977.

This report summarizes the 1982 activities and the relative impacts of those activities on the fishery resources and the energy supply. A team of fishery agencies, Corps of Engineers, Bonneville Power Administration, and Public Utility District staff members prepared this report.

Co-chairmen for the Committee in 1982 were Roger Hearn, BPA, and Charles Koski, NMFS. Teri Barila, BPA, served as Secretary.

Jim Cayanus of the Corps of Engineers and Terry Holubetz of the Columbia River Fisheries Council provided liaison between the water and energy management agencies and the fish and wildlife agencies during the fish flow operation.

SUMMARY

The fisheries operation program was conducted for the sixth consecutive year since 1977. Water and energy management agencies and fish and wildlife agencies worked together to improve the survival of migrating salmon and steelhead in the Snake and Columbia Rivers. Management of flows and spill was the major element in this year's operation due to the abundant runoff.

The 1982 runoff was the largest volume runoff that the fisheries flow coordination effort has managed (129.9 MAF) and provided sufficient flow for both energy and fish flows. The high flows caused difficulty in striking a balance between the following fisheries objectives:

- Provide spill for safe passage of juvenile migrants at dams that do not have bypass systems.
- Distribute spill to provide suitable adult salmon and steelhead passage conditions.
- Distribute spill to control supersaturated gas levels.
- Maximize collection and transportation of juvenile migrants at the collector dams: McNary, Lower Granite, and Little Goose.

Flow and spill objectives for improving survival of juvenile migrants were generally met or exceeded during the spring migration period. Capacity of the hydroelectric system greatly exceeded the energy demand throughout the spring migration, and involuntary or forced spill was abundant.

1. Very high flows that occurred in the latter part of May and early June required special operations to prevent dissolved gases caused by high

amounts of spill from reaching lethal levels for migrant salmon and steelhead. Energy storage and exchanges both within the region and outside the region were arranged to reduce spill at mainstem projects in the late spring period. Efforts to reduce the adverse effects of high levels of dissolved gases on salmon and steelhead were successful and incidence of gas bubble disease in fish was minimal in 1982.

2. Sufficient spill or more than sufficient spill was provided at dams that are not equipped with adequate bypasses during the spring migration period. The fish and wildlife agencies believed that insufficient spill was provided at these dams during the summer migration period (see Appendix 2). The U.S. Army Corps of Engineers maintained that adequate spill was provided when migrants were determined to be present by their sonar observations (Appendix 2).

3. A total of 2.1 million chinook salmon and 4.3 million steelhead smolts were estimated to have arrived at Lower Granite Dam. Approximately 0.7 million chinook salmon (32%) and 2.4 million steelhead (55%) were collected at Lower Granite and Little Goose dams of which most were transported by truck and barge to release areas below Bonneville Dam.

4. Survival of those smolts that were not transported and migrated downriver from Lower Granite to John Day was estimated to be 54 percent for steelhead and 25 percent for chinook salmon.

5. Average travel time for non-transported smolts migrating from Lower Granite Dam to John Day Dam was 14 days for chinook salmon and 9 days for steelhead. The importance of flows in providing downstream passage continues to be demonstrated. (During low flows in 1977, travel time from Lower Granite Dam to John Day Dam for steelhead smolts was 36 days).

6. During the spring outmigration, approximately 6.0 million smolts were estimated to have passed McNary Dam of which 820,000 yearling chinook, 64,000 coho, 175,000 sockeye, and 440,000 steelhead and most were transported below Bonneville Dam.

7. The summer migration of subyearling chinook was estimated to be over 8.0 million fish at McNary Dam, the largest since the National Marine Fisheries Service began making estimates in 1972. A total of 1.6 million were transported from McNary Dam and 6.6 million were estimated passing John Day Dam.

An additional 3.0 million subyearling chinook from a release in the Umatilla River in April passed John Day Dam in late April.

8. There was significant mortality of yearling chinook as in 1981. Only 1.8 million (41%), about the same as 1981, survived to John Day Dam out of a potential 4.3 million fish from areas above McNary Dam. Poor quality of fish rather than fish passage was believed to be the major cause of the lower than expected survival.

9. A combined total of 15.8 million fish (6.0 million transported and 9.8 million nontransported fish) reached the river below Bonneville Dam in 1982. Of these 8.0 million were summer migrants and 8.0 million were spring migrants. The summer migration was the highest of record, while the spring migration was the lowest estimated since 1977.

10. Numbers of adult migrant spring chinook, fall chinook, and coho were increased over the last several years and steelhead greatly increased. Sockeye and summer chinook runs did not increase in 1982, but were comparable to the 1981 run sizes. All Snake River stocks showed a general increase over runs of the past several years.

11. Large quantities of spill were transferred from the Federal system to the mid-Columbia projects to improve survival of downstream migrants at the mid-Columbia projects and to assist in the control of dissolved gases at all mainstem projects.

12. During the period 13 April 1982 to 18 May 1982, the fish and wildlife agencies and tribes opted not to maximize transportation at Lower Granite and LIttle Goose dams in favor of the higher priority objectives of distributing spill to improve survival of both adult and juvenile migrants passing mainstem projects and distributing spill to control supersaturated gas levels.

13. During the actual fish flow operation, the interface between power/water management entities and the fisheries management entities was accomplished primarily through staff of the Corps of Engineers and the Columbia River Fisheries Council. For the mid-Columbia Projects, the designated representatives under the ongoing FERC proceedings were used to determine priorities and timing of spill used for protection of downstream migrant salmon and steelhead juveniles.

Section I

INTRODUCTION

History of COFO

In response to an appeal by fishery agencies in 1975 that every effort be made to improve the survival rate of migrating adult and juvenile salmon and steelhead in the Columbia and Snake Rivers, top administrators of the fish and water management agencies, including public and private utilities, met on 20 February 1975, to review the problems. As a result of this meeting, the Ad Hoc Committee on Fishery Operations was formed under the aegis of the Columbia River Water Management Group on 11 March 1975. The Ad Hoc Committee consisted of technical representatives of each of the companies and agencies attending this meeting. The Ad Hoc Committee in turn established a fourteen member work group comprised of representatives from the following agencies:

- Corps of Engineers
- Bureau of Reclamation
- Washington Department of Fisheries
- National Marine Fisheries Service
- Grant County PUD
- Douglas County PUD
- Bonneville Power Administration
- Fish Commission of Oregon
- Idaho Department of Fish & Game
- Intercompany Pool (private utilities)
- Chelan County PUD

At the first meeting in 1976, it was decided it was unnecessary to keep both the Ad Hoc Committee and the work group and it was agreed that the work group would serve as the Committee on Fishery Operations. It was also decided to have co-chairmen of the committee with one selected from the operating agencies and one from the fishery agencies. The Committee on Fishery Operations has continued to operate in this manner since 1976.

The record low runoff in 1977 was a real test of the committee's capability to develop a workable compromise plan of efficient water use for fish, power, irrigation, and other water uses. The governors of Oregon, Washington, and Idaho assisted in arriving at a compromise plan.

The passage of the Northwest Power Planning Act of 1980 has elevated the standing of these efforts to improve the survival of migrating salmon and steelhead, and has provided a congressional mandate to continue and expand this type of work.

In 1982, the Committee on Fishery Operations functioned in a manner similar to that of previous years, as the Northwest Power Planning Council did not develop the Fish and Wildlife Program until the fall of 1982. The Fish and Wildlife Program will provide direction for fish flow operations in future years.

Cooperating Agencies and Projects

The Columbia River Basin is highly developed for multiple beneficial purposes including: fish and wildlife, power, irrigation, navigation, flood control, municipal and industrial water supply, recreation, and water quality. Water serves many functions in the Pacific Northwest and many agencies and interests are involved in the management of this resource. Coordination and cooperation among these many agencies and interests are facilitated, promoted, and even required in numerous ways. Overall, reason and logic and a domestic peer relationship generally prevails. Underlying, there is a framework for formal legal requirements and contracts.

The Committee on Fishery Operations has been a voluntary organization that helped bridge differences and promote better coordinated reservoir system regulations. During 1982, representatives of the following agencies participated in one or more of the meetings of this committee.

Fishery Agencies:

- National Marine Fisheries Service (NMFS)
- Oregon Department of Fish and Wildlife (ODFW)
- Idaho Department of Fish and Game (IDFG)
- Washington Department of Fisheries (WDF)
- Washington Department of Game (WDG)
- U.S. Fish and Wildlife Service (USFWS)
- Columbia River Inter-Tribal Fish Commission (CRITFC)
- Columbia River Fisheries Council (CRFC)

Federal Water Management Entities:

- U.S. Army Corps of Engineers (COE)
- Bonneville Power Administration (BPA)
- Bureau of Reclamation (BR)
- Federal Energy Regulatory Commission (FERC)

Non-Federal Water Management Entities:

- Grant County Public Utility District (PUD)
- Chelan County PUD
- Douglas County PUD
- Portland General Electric
- Pacific Power and Light
- Intercompany Pool
- Pacific Northwest River Basins Commission
- Washington Department of Ecology
- Oregon Department of Water Resources
- Idaho Power Company
- Idaho Department of Water Resources

The Columbia Basin dam and reservoir projects most directly affected by the 1982 special fishery operation are located in Oregon, Washington, Idaho and Montana. The operation of and effect on these reservoirs was considerably different for various projects. The projects listed in upstream order and the responsible operating agencies are:

Lower Columbia River	- Bonneville (COE)
	The Dalles (COE)
	John Day (COE)
	McNary (COE)
Lower Snake River	- Ice Harbor (COE)
	Lower Monumental (COE)
	Little Goose (COE)
	Lower Granite (COE)
Mid-Columbia River	- Priest Rapids (Grant PUD)
	Wanapum (Grant PUD)
	Rock Island (Chelan PUD)
	Rocky Reach (Chelan PUD)
	Wells (Douglas PUD)
Storage Projects	- Dworshak (COE)
	Brownlee (IPC)
	Grand Coulee (BR)
	Hungry Horse (BR)
	Libby (COE)

There are, of course, many additional projects in the Columbia Basin, most of which were not affected by the 1982 operation. Spill was transferred to the following projects to control levels of supersaturated gases caused by excessive spill at mainstem Columbia and Snake River projects:

Ruskin (BC Hydro)

Seton (BC Hydro)

Clowhom (BC Hydro)

Seven Mile (BC Hydro)

Cheakamus (BC Hydro)

Kootenay Canal (BC Hydro)

Waneta (West Kootenay, B.C.)

Brilliant (West Kootenay, B.C.)

Noxon (WMP)

Cabinet Gorge (WWP)

Williston (B.C. Hydro)

Big Cliff (COE)

Foster (COE)

Dexter (COE)

Hills Creek (COE)

Cougar (COE)

Lost Creek (COE)

Albenai Falls (COE)

Boundary (SCL)

Pelton (PGE)

Brownlee (IPC)

Dworshak (COE)

Kerr (MP)

COFO Meetings 1982

Meetings of COFO were held on February 16, March 30, June 22, and November 30. A work group met more frequently in the late winter and early spring in repeated attempts to develop an operating plan that both fishery agencies and water management agencies could support. A Detailed Fishery Operating Plan for 1982 (DFOP) was developed prior to the spring migration and was used for general guidance in the 1982 operation.

The need for coordination in COFO was reduced in 1982 because of the high flows and high levels of forced spill that occurred during the spring migration. The meetings did provide the necessary opportunities for coordination. The combination of an abundant water supply in the Columbia River Basin, the FERC Settlement Agreement regarding spill at mid-Columbia projects, and the experience gained from previous years' operations made the 1982 fisheries operation less complicated than in previous years.

Water Supply Forecasts and Runoff

The forecasts of runoff for the Columbia River at The Dalles for the January-July period increased monthly from 100 percent of average based on data as of 1 January to 120 percent as of 1 May. May precipitation was well below normal. Consequently, the forecast of 1 June dropped to 117 percent of average. The fifteen year (1963-1977) average runoff at The Dalles for the January-July period os 109.6 million acre feet (MAF). The actual runoff in 1982 for the January-July period was 129.9 MAF or 119 percent,of average. Figure 1 displays the runoff forecast by months for 1982 and the monthly precipitation. Table 1 gives a comparison of monthly forecasts of the January-July runoff'of the Columbia River above The Dalles versus actual runoff for the years 1970 through 1982.

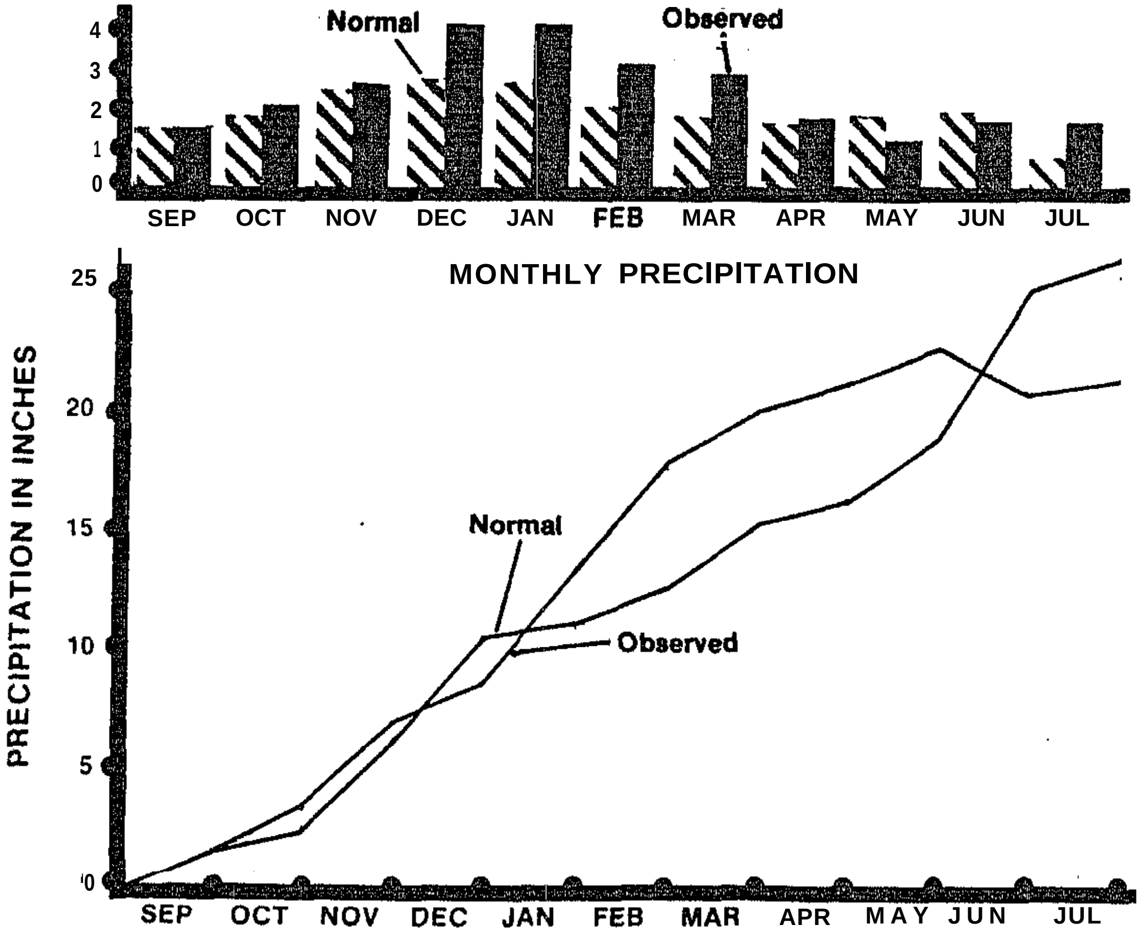
TABLE 1

Comparison of Monthly Forecasts of the January-July Runoff of the Columbia River above The Dalles vs. Actual Runoff

(Measured in MAF (million acre-feet))

(Normal is 109.6 MAF)

Year	Jan	Feb	Mar	Apr	May	Jun	Actual
1970	82.5	99.5	93.4	94.3	95.1	--	95.7
1971	110.9	129.1	126.0	134.0	133.0	135.0	137.5
1972	110.1	128.0	130.7	146.1	146.0	146.0	151.7
1973	93.1	90.5	84.7	83.0	80.4	78.7	71.2
1974	123.0	140.0	146.0	149.0	147.0	147.0	156.3
1975	96.1	106.2	114.7	116.7	115.2	113.0	112.4
1976	113.0	116.0	121.0	124.0	124.0	124.0	122.8
1977	75.7	62.2	55.9	58.1	53.8	57.4	53.8
1978	120.0	114.0	108.0	101.0	104.0	105.0	105.6
1979	88.0	70.6	93.0	87.3	89.9	09.7	83.1
1980	88.9	88.9	68.9	89.7	90.6	97.7	95.8
1981	105.0	84.7	84.5	81.9	83.2	95.9	103.5
1982	110.0	720.0	126.0	130.0	131.0	128.0	129.9



ACCUMULATIVE PRECIPITATION

1981-1982 Precipitation Index, Columbia River Basin above The Dalles

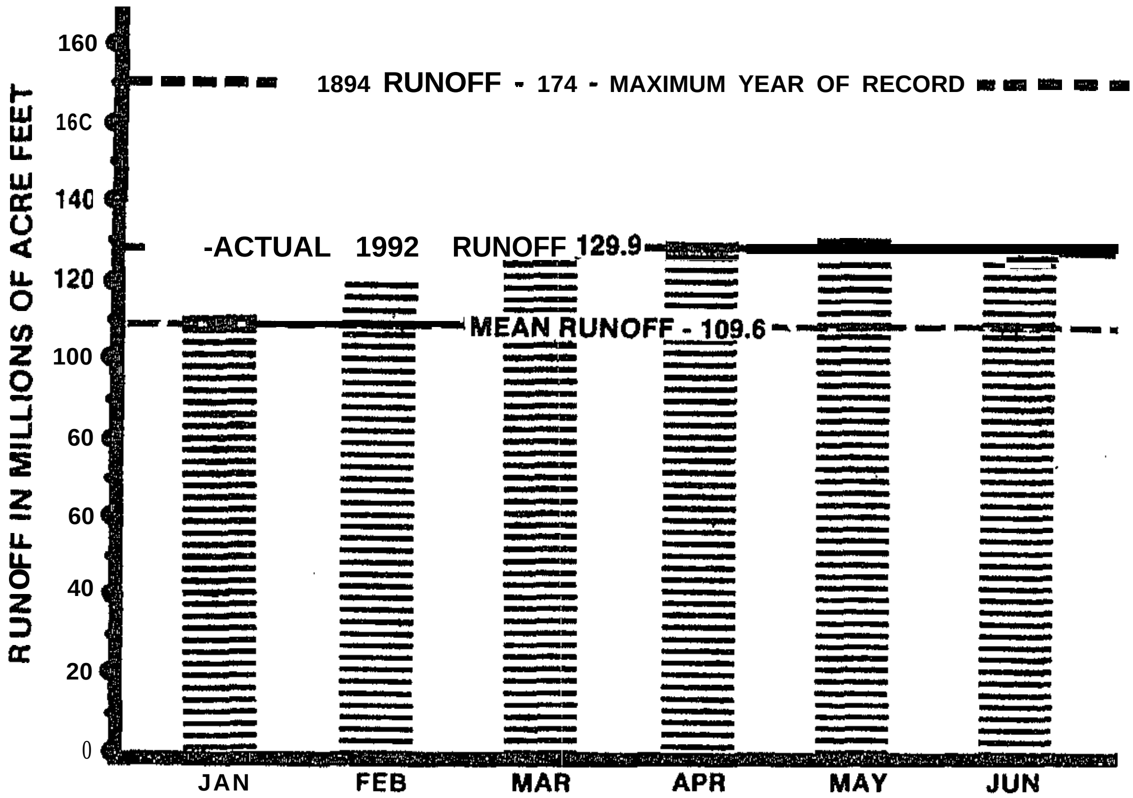


Figure 1 BEGINNING OF MONTH FORECAST

January-July 1982 Runoff forecast verification, Columbia River at The Dalles

Source : COE/NPD

Section II

DEVELOPMENT OF A PLAN OF ACTION

Detailed Fishery Operating Plan

Between January 26, 1982 and March 30, 1982, a work group composed of representatives of fishery agencies, Indian tribes and water/energy management agencies prepared a plan for the 1982 operation. Complete agreement was not reached on all specific operations for improvement of fish survival. However, a general set of guidelines was developed by the work group prior to March 30, 1982 and approved by COFO on March 30, 1982 (Appendix 1). The Detailed Fishery Operating Plan (DFOP) did not address the summer migration period.

Fishery Agency Requests for 1982

The basic recomendations for flow and spill were contained in the operating plan, but as the nature of the runoff and associated water management needs became apparent for the spring of 1982, the fishery agencies made a number of requests to alter water and energy management to provide the best possible survival conditions for migrating anadromous fish. These inseason requests were intended to take full advantage of current information on changing stream flows and fish migrations (see Appendix 2).

Plans contained in the DFOP for provision of voluntary spill were displaced to a considerable degree by continually changing recommendations to distribute large volumes of forced spill that were occurring in the Federal System. Operation of key storage projects in the Snake River drainage was requested to be changed to sustain a flow of 120,000 cfs at Lower Granite Dam. Storage in the mid-Columbia was used to hold the flows in the range of 140,000 to 190,000 cfs.

Implementation of Flows for Fish

During March and early April, the COE, BPA, and BR reviewed the water supply forecasts, reservoir status, power load forecasts, the FERC order for the mid-Columbia PUDs, and the fishery agencies' recommendations to determine what flows and spills could be provided to assist the juvenile migration past mid-Columbia and Federal projects. In view of the above normal runoff forecast on 1 March (110 percent of normal), the operating agencies agreed to modify their project operations in 1982 to provide supplemental flows early in the season for juvenile passage if the natural flows were not adequate.

The COE, BR, and BPA agreed to tailor power marketing to conserve water in headwater storage reservoirs and to modify flood control requirements for Dworshak and Brownlee Reservoirs, allowing those projects to be above normal flood control levels at the beginning of the smolt migration. Also, Grand Coulee was operated to the flood control draft levels but above the normal power draft level early in the water year. The operating agencies further agreed to modify the Columbia River system operation to provide optimum flows in the Columbia and up to 120,000 cfs at Lower Granite by fully loading Dworshak and late evacuation of Brownlee Reservoir.

BPA requested again this year that the fishery agencies consider weekly average flows rather than daily average flows to reduce over-generation on weekends. The CRFC did not respond to this request. However, due to the sustained high natural runoff, this did not create any serious problem! in scheduling project outflows.

The fishery agencies on 16 April requested that flows of 120,000 cfs be provided at Lower Granite beginning immediately and also requested Lower Granite and Little Goose loading not be shaped to maximize collection, and that these two projects be moved up on the spill priority list to provide spill for juvenile passage and control of dissolved gases.

At Lower Monumental, Ice Harbor, and John Day dams, the COE agreed to provide spill of up to 10 percent of the daily average flow when monitoring by the COE and the fishery agencies indicated significant numbers of juveniles were passing these projects.

The Ice Harbor ice and trash sluiceway was modified to pass more water to provide a skimmer bypass and was expected to reduce the need for spill. Studies were conducted to evaluate the effectiveness of the sluiceway in safely bypassing downstream migrants. The need for spilling at Ice Harbor Dam was to be based on the results of the studies. However, forced spill was abundant at the project throughout the spring migration.

No spill was requested at McNary because the units were screened at the start of the season. DFOP provided direction for collecting and hauling as many juveniles as possible at Lower Granite, Little Goose and McNary. The Dalles ice and trash sluiceway was utilized to bypass juveniles again in 1982, therefore, no voluntary spill was requested. The collection and hauling program at Lower Granite and Little Goose was expected to significantly reduce the numbers of juveniles reaching Lower Monumental and Ice Harbor and, therefore, reduce the need for spill at these two projects. For juvenile passage during the spring outmigration, Bonneville Dam was expected to have sufficient forced spill to provide passage when combined with the operation of the ice and trash sluiceway in the first powerhouse and the fingerling bypass system in the second powerhouse.

High flows caused forced spill on the system from April through early August. The abundance of forced spill rendered plans for voluntary spill moot. There was nearly continuous forced spill during much of the spring. The major concern during the spring migration was controlling dissolved gas levels in both the Snake and Columbia rivers. Flows were at or above minimums throughout the spring migration and above optimum levels during most of the period. The hourly spill and total discharge amounts at each of the nine mid- and lower Columbia projects plus the four projects on the Snake River are displayed in Appendix 4. Individual project operations are discussed in Section III.

Implementation of Fish Transportation Program

Smolt transportation was initiated on 1 April with the first truckload of juvenile fish transported on that date from McNary Dam. The first load was transported by truck from Lower Granite Dam on 6 April, and from Little Goose Dam on 10 April.

The first barge load of fish departed from Lower Granite on 20 April and the last barge departed McNary Dam on 10 June.

Transportation operations were completed at Lower Granite Dam on 29 July, Little Goose Dam on 21 July, and at McNary Dam on 24 September.

The 13 April request by the fishery agencies to spill at Lower Granite and Little Goose rather than operating to maximize collection and transportation (see Appendix 2) was a significant departure from the planned transportation program and the DFOP. This reduced the numbers of fish available for collec tion and transportation from 17 April through 17 May. The fishery agencies requested that collection and transportation be maximized on 17 May (Appendix 2).

FERC Petition and Agreement/Ruling

On 4 March 1980, the FERC issued a Settlement Agreement Order which established flow and spill levels required to be provided at the PUD projects and operated in the mid-Columbia River. A copy of the Settlement Agreement is contained in Appendix 1. The Order also establishes a five-year study program and hatchery operations that are to be conducted commencing in 1980. During 1982, flows and spills were provided in compliance with this Order.

TABLE II

1982 WEEKLY SPECIES COMPOSITION AT McNARY DAM

WEEK	SUBYEARLING CHINOOK	YEARLING CHINOOK	STEELHEAD	COHO	SOCKEYE
31 Mar-3 Apr:		100[1]			
4-10 Apr		100			
11.17 Apr		83.3[1]	13.2		1.5
18-24 Apr	12.2	43.6	36.6		7.6
25 Apr-1 May	0.1	68.5	24.8	0.1	6.5
2-a May	0.26	61.8	23.6	0.01	14.3
9-15 May	.23	62.3	28.3	1.1	1.9
16-22 May	2.0	44.6	26.2	16.9	10.3
23-29 May	19.7	20.6	20.3	16.9	22.5
30 May-5 June	51.1	10.4	14.7	3.6	20.2
6-12 June	86.2	3.3	6.0	0.7	3.8
13-19 June	92.6	1.3	4.8	0.3	1.0
20-26 June	98.5	0.5	0.8		0.2
27 June-3 July	98.6	0.2	0.8		0.4
4-10 July	90.3		0.2	0.1	9.4
11-17 July	94.9	0.1	0.1		4.9
18-24 July	99.3				0.7
25-31 July	99.6				0.4
1-7 August	99.4				0.6
8-14 August	99.3				0.7
15-21 August	97.5	2.1			0.4
22-28 August	82.0	17.6	0.1		0.3
29 Aug-4 Sept	94.3	5.5		0.0	0.2
5-11 Sept	97.3	2.2	0.1		0.4
12-15 Sept	97.5	2.2			0.3
19-24 Sept	97.7	2.0			0.3

[1] No species composition determined until 14 April 1982

Section III

PROJECT OPERATIONS AND MONITORING OF SMOLT MIGRATIONS

Monitoring of smolt migrations was conducted to determine the timing of runs past projects. This information was used by coordinators responsible for scheduling daily flows and spill. Samples of smolts were taken from fingerling collection facilities at Lower Granite, Rock Island, and McNary dams and from turbine intake gatewells at Priest Rapids and John Day dams. Index numbers of fish were derived to correspond with the 10th, 25th, 75th. and 90th percentiles of fish passage based on histories of smolt migration at the projects and estimated magnitude of migrations from upriver tributaries. Spills or changes in spills were to be initiated when the daily sample of fish collected at a project was equal to the predetermined index number. The decisions to spill at Lower Monumental and Ice Harbor dams were to be based upon information from collections of fish at Little Goose Dam and sonar monitoring.

The 1982 runoff was well above nonnal and there was usually more than sufficient spill to pass fish over the spillways at dams without bypasses, and there was little need for the index numbers to trigger spill. However, the resultant high spill at some dams could cause gas suyersaturation problems. During late May and June, monitoring of dissolved gas levels and observations of fish to determine effects of the supersaturated water became important. To minimize the problem, nitrogen abatement. procedures were undertaken whenever dissolved gas supersaturation approached critical levels. These measures consisted primarily of minimizing spill at dams that increase supersaturation, maximizing spill at projects that did not increase supersaturation, spreading the spill to minimize air entrainment, and transferring energy and/or spill from mainstem projects to projects outside of the migration area, and projects located outside of the Columbia River Basin. Timing and location of both upstream and downstream migrations during the period were considered when making decisions on prioritization of spill at mainstem projects and spill transfers. Smolt indices data were provided daily to the smolt coordinator for this purpose.

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Operation of the individual projects is discussed in the following paragraphs:

Mid-Columbia River Projects

Wells Dam

Flows during the spring smolt migration ranged from 116,000 cfs to 193,000 cfs and averaged 167,000 cfs. On all but 3 days, flows were above the optimum flow recanmendations of the CRFC. The high flows, together with transfers of excess federal spill provided high levels of spill for protection of juveniles through most of the migration. The percent of daily average river discharge that was spilled ranged from 12% to 50%, and averaged 33% for the last half of April and all of May. By comparison, spill averaged 4% in 1981 for the same period. Daily average flow, percent spill, and the amount of spill each day broken into categories of federal, forced, and FERC spill is given in Table 3. Extensive transfers of federal spill (over 68% of the total spill) minimized the need to use FERC spill.

Monitoring of downstream migrant salmon and steelhead trout at Wells Dam was accomplished by trapping migrants in the Okanogan River, purse seining in the forebay, and hydroacoustic sampling at the dam. The objective of this sampling was to provide additional information on the abundance and seasonal timing of the downstream migration by species and to provide an evaluation of the effectiveness of spill for protecting migrating salmonids.

Juvenile sockeye salmon rear naturally in Lake Osoyoos and migrate out of the Okanoyan River. Biosonics, Inc. conducted a pre and post migration hydroacoustic survey of Lake Osoyoos to provide information on the size of the sockeye outmigration. A sampling effort utilizing an incline plane trap was conducted again to provide additional information on the timing of the sockeye outmigration. Sampling began on 7 April and continued until 19 May when the trap was damaged by debris. Peak periods of migration occurred from 25 April through 30 April and again from 12 Ray through 19 May when sampling was terminated (Figure 2).

Table 3.--Wells Dam spill.

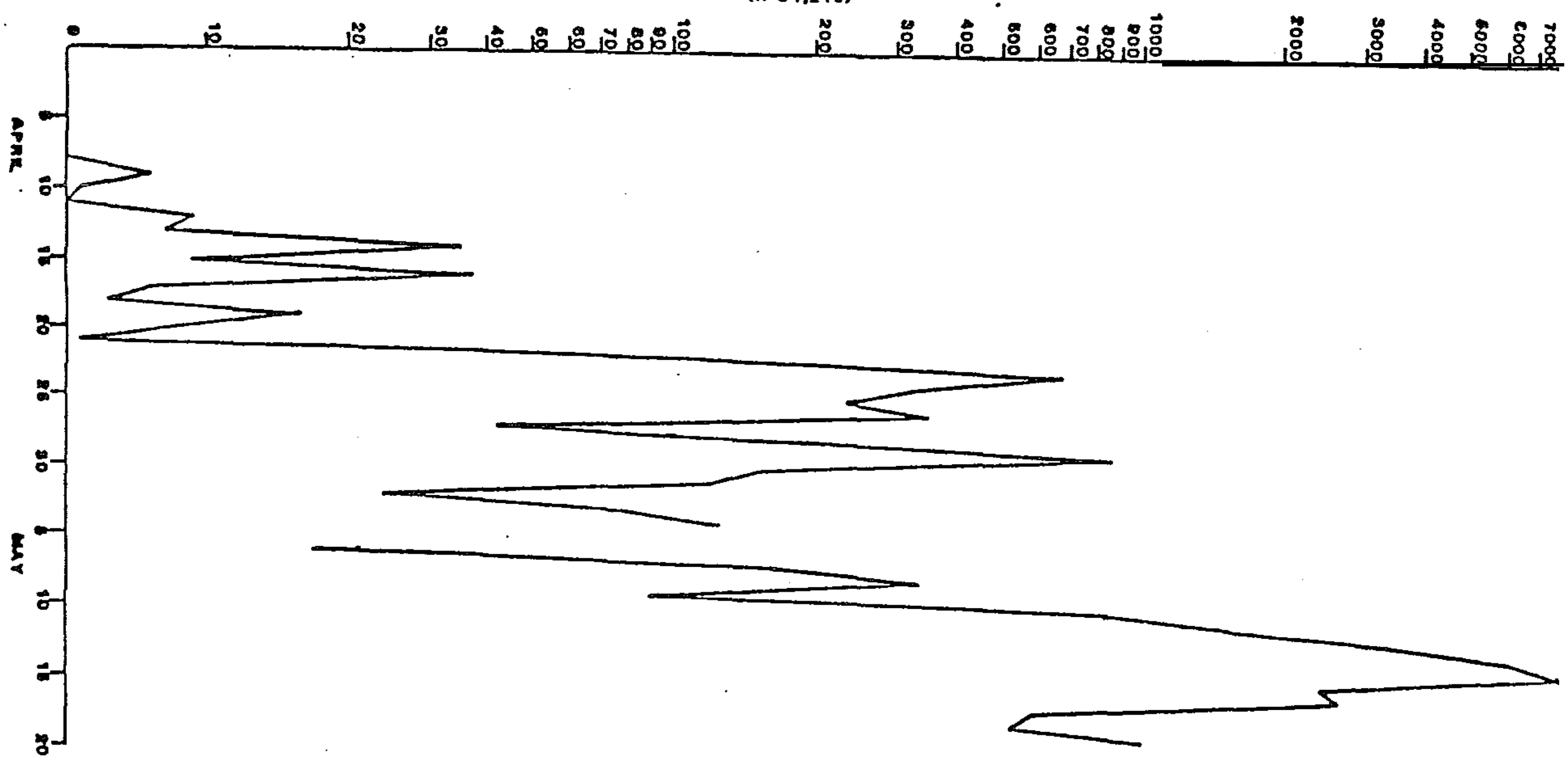
Date	River discharge KCFS	Federal[a] energy replacement spill	Amount of spill (acre-feet) Forced[b] spill	FERC spill	Total spill	%[c] spill
April						
17	169.5	43.8	1.8		45.6	14
18	191.8	62.6	55.1		117.7	30
19	183.6	72.4	50.5		122.9	33
20	155.2	70.4	9.6		80.0	26
21	151.6	72.8	0		72.8	24
22	146.1	107.0	0		107.0	37
23	138.3	45.4	0		45.4	16
24	145.4	97.1	0		97.1	34
25	116.3	82.6	0.3		82.9	35
26	125.9	37.2	0		37.2	15
27	120.0	37.2	0		37.2	16
28	131.3	24.8	0	9.9	34.7	14
29	121.4	0	0	27.8	27.8	12
30	125.2	28.1	2.7	4.1	34.9	14
May						
1	143.8	82.6	7.3	0	89.9	31
2	164.8	99.1	26.0	0	125.1	38
3	164.5	45.4	58.6	0.8	104.8	32
4	173.3	35.5	97.8	0	133.3	39
5	169.3	109.9	28.2	0	138.1	41
6	165.2	115.6	26.8	0	142.4	43
7	164.3	115.6	22.8	0	138.4	42
8	185.9	138.8	61.3	0	200.1	54
9	188.7	138.8	64.0	0	202.8	53
10	175.0	52.0	26.7	0	78.7	22
11	156.5	71.6	32.5	0	104.1	33
12	149.3	58.7	9.1	32.9	100.7	33
13	163.5	25.5	0.8	24.5	50.8	15
14	161.6	102.4	0	0.4	102.8	31
15	172.6	132.2	44.8	0	177.0	51
16	174.2	120.9	44.2	0	165.1	48
17	174.4	109.0	63.1	1.5	174.5	50
18	194.5	62.8	33.8	17.1	113.7	29
19	192.4	109.0	31.7	24.4	165.1	43
20	198.9	84.3	37.0	44.1	165.4	41
21	191.7	108.2	47.8	13.2	169.2	49
22	189.6	40.5	51.5	7.4	99.4	26
23	185.0	82.6	60.8	0	143.4	38
24	191.5	40.5	65.3	4.0	109.8	29
25	193.1	34.7	44.8	13.3	92.8	24
26	192.5	34.7	45.8	12.6	93.1	24
27	186.8	34.7	21.6	7.6	60.9	17

Table 3.--Wells Dam spill (continued).

Date	River discharge KCFS	Amount of spill (acre-feet) Federal[a] energy replacement spill	Forced[b] spill	FERC spill	Total spill	%[c] spill
28	186.3	63.6	59.8	6.7	130.1	35
29	179.4	132.2	30.9	--	163.1	46
30	178.4	138.8	28.8	--	167.6	49
31	172.5	67.7	27.2	--	94.9	27
	TOTALS	3370.2	1320.8	252.3	4943.3	

a/ Electrical energy from the federal system equivalent to the amount that Wells Dam could have produced with the volume of water spilled.
b/ Forced spill for reservoir elevation control.
c/ % of daily average river flow spilled each day.

FIGURE 2. NUMBER OF JUVENILE SOCKEYE CAUGHT PER DAY IN THE OKANAGAN RIVER 1982
(source Douglas County PUD).



Purse seine sampling in Wells Dam forebay was conducted from 12 April to 29 May. Chinook smolts were captured from 14 April to the end of sampling. The majority of the chinook were collected between 22 April and 7 May. Steelhead were first captured on 22 April and catches continued sporadically through the entire study period. Sockeye were first collected on 21 April with peak catches on 14 May and 24 May. Sockeye were still being collected in the forebay when sampling was terminated.

Hydroacoustic sampling at Wells Dam was conducted by Biosonics, Inc. from 7 April to 23 May. Study objectives were to provide comparative indices of migrant passage and to provide fish spills when migrants were present in the forebay. The effectiveness of spill for fish passage at Wells Dam was also investigated by examining the vertical distribution of migrants at the face of the dam and in powerhouse and spillway discharge. The evening and early morning hydroacoustic indices for Wells Dam in 1981 and 1982 are illustrated in Figure 3. As can be seen, the migration was bimodal with one peak in mid-April (mostly chinook smolts) and the second peak in mid-May (mostly sockeye).

Rocky Reach Dam

Spill timing and quantities were determined by the Designated Representatives (one utility District biologist and two fishery agency biologists). The Designated Representatives consulted with the Smolt Coordinator to make best use of federal system transfers of forced spill and shape the spill program to match the fish migration by providing the highest quantities and most hours of spill during peaks in fish abundance. At times when considerable forced spill was available, the Designated Representatives worked with the Smolt Coordinator to avoid gas supersaturation while maintaining optimal downstream fish passage conditions.

The optimal spill configuration for fish passage at Rocky Reach, as determined by concensus of the Designated Representatives based on the available evidence, consisted of one or more spill gates open full to

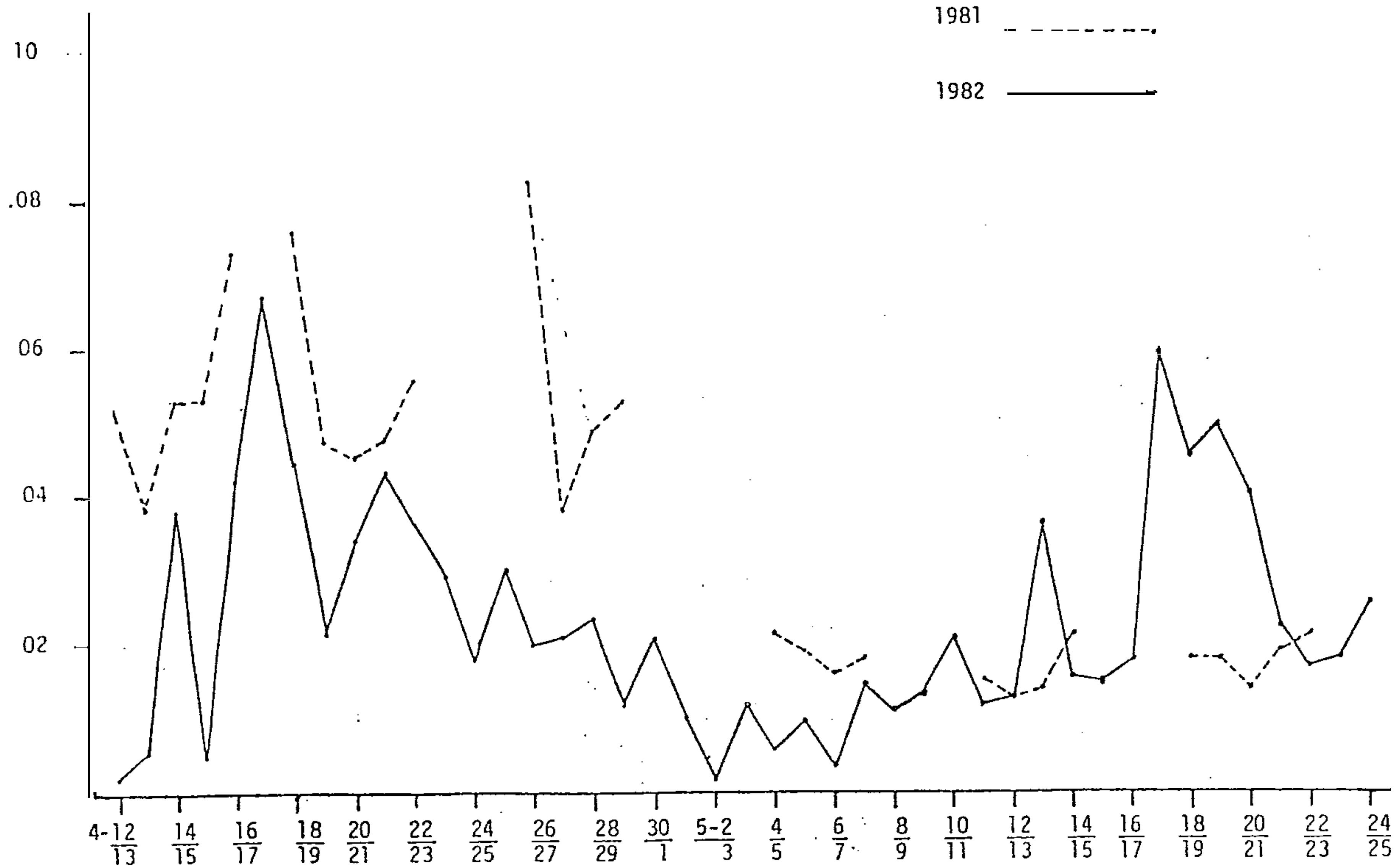


FIGURE 3. HYDROACOUSTIC INDICES FOR WELLS DAM 1981 AND 1982 - 1600-0700 HOURS

provide surface attraction flows. Spill gates 3 and 4 were the primary gates used since they were both rated for full flow (30,000 cfs each) and were located near the powerhouse, where attraction flows provided the best conditions for passing fish migrating down either side of the river. When spillway flows exceeded 60,000 cfs additional gates were used to spill the remainder. Spill was provided during the nighttime period of peak fish passage (2200 to 0600 hours) early in the season when limited spill was available. After 5 May, when high streamflows caused more spill, at least 30,000 cfs of spill was provided at all times of the day.

Due to abundance of federal system transferable spill and energy transfers, a spill accounting system was developed to avoid depleting the spill quota of the FERC Settlement at times when system energy replacement spill was available. The FERC quota was used to provide spill at times when insufficient transferable system spill and forced spill were available, thus maximizing fish survival benefits. In addition, due to high river flows and limited turbine capacity, considerable forced spill occurred in excess of the level required for optimum fish passage. Spill accounting is summarized in Table 4.

The FERC spill quota, based on the 1 April yearly runoff forecast, was 669,000 acre-feet plus an additional 100,000 acre-feet of supplemental volume since the fish migration lasted more than 30 days. The Rocky Reach spill program utilized 560,132 acre-feet. or 73% of the quota, which resulted in energy losses of 28,581 MWH. The FERC spill quota was used from 17 April through 31 May, Federal system transferable spill amounted to 2,261,568 acre-feet during the period from 16 April through 31 May, and continued to occur through June and into July for purposes of dissolved gas abatement. Forced spill from 16 April through 31 May was 1,864,083 acre-feet. Total spill at Rocky Reach during the spring juvenile salmonid migration (16 April-31 May) was 4,685,784 acre-feet.

Rocky Reach spill volumes ranged from 6.4% to 72.4% of the daily average flow during the 16 April through 31 May period. The spill averaged 29% during this period, and can be compared to a 6.7% average for the same period in 1981. Spill was greater than 9% except for one day, from

Table 4 .--Rocky Reach Dam Spill.

Date	Daily Stream flow (CFS)	Daily spill (CFS)	%Stream flow spilled	FERC[a/] Settlement spill (CFS)	Energy foregone (MWH)	Federal[b/] transferable spill (CFS)	Force spil (CFS
April							
16	187,200	47,800	25.5	-0-	-0-	10,417	37,38
17	174,500	28.600	16.4	-0-	-0-	14,583	14,01
18	188,900	47,600	15.2	-0-	-0-	14,583	33,01
19	192,700	42,400	22.0	-0-	-0-	2,083	40,31
20	159,100	23,900	15.0	2,488	310	14,583	6.82
21	153,500	32,800	21.4	2,463	285	27,917	2.42
22	147,300	16,400	11.1	-0-	-0-	16,359	4
23	144,320	9,242	6.4	-0-	-0-	9,242	-0-
24	123,470	23,890	19.3	-0-	-0-	23,890	-0-
25	116,810	18,710	16.0	-0-	-0-	18,710	-0-
26	129,300	11,950	9.3	2,317	297	9,633	-0-
27	129,170	14,360	11.1	1,013	135	8,750	4,59
28	133,160	15,430	11.6	8,000	1,062	7,430	-0-
29	118,210	11,760	9.9	11,760	1,606	-0-	-0-
30	127,090	14,820	11.7	7,167	957	3,750	3,90
May							
1	127,850	25,780	20.1	-0-	-u-	24,513	1,267
2	159,350	38,570	24.2	-0-	-0-	29,979	8,591
3	172,610	39,420	22.8	20,516	2,299	16,196	2,708
4	168,620	48,900	29.0	6,238	513	23,508	19,154
5	165,780	42,270	25.5	Y ,900	1,102	23,630	8,740
6	165,350	46,240	28.0	4,963	521	24,946	16,331
7	162,880	36,100	22.2	6,133	699	23,554	6,413
8	186,400	62,800	33.7	-u-	-0-	30,000	32,800
9	190,400	78,100	41.0	-0-	-0-	30,000	48,100
10	185,500	42,700	23.0	19,754	2,162	9,942	13,004
11	163,900	21,700	13.2	10,083	1,273	7,358	4,259
12	160,700	17,400	10.8	10,204	1,307	7,196	-0-
13	158,300	21,800	13.8	11,929	1,477	9,833	38
14	146,900	29,400	20.0	8,517	1,031	20,883	-0-
15	163,400.	48,800	29.9	-0-	-0-	29,908	18,892
16	174,600	55,700	31.9	-0-	-0-	29,983	25,717
17	190,400	76,800	40.3	6,204	533	23,750	46,846
18	177,600	83,200	46.8	8,508	649	51,721	22,971
19	190,400	93.500	49.1	7,488	548	54,321	31,691
20	198.400	99.900	50.4	6,238	443	54,608	39,054
21	193,930	82,080	42.3	12.492	1,031	35,620	33,968
22	182,230	59.030	32.4	19,920	1,931	26,145	12,965
23	186,720	81,860	43.8	-0-	-0-	48,696	33,164
24	194,000	65,170	33.6	22,429	2,110	19,550	23,191

Table 4.--Rocky Reach Dam Spill (continued).

Date	Daily Stream flow (CFS)	Daily spill (CFS)	%Stream flow spilled	FERC[a/] Settlement spill (CFS)	Energy foregone (MWH)	Federal[b/] transferable spill (CFS)	Forced spill (CFS)
25	188,300	93,975	49.9	10,000	720	32,500	51,475
26	192,980	82,080	42.5	22,513	1,848	20,000	39,567
27	181,380	81,820	45.1	8,750	701	28,333	44,737
28	195,120	105,390	54.0	8,658	578	29,583	67,149
29	180,040	126,550	70.3	-0-	-0-	75,771	50,779
30	178,000	128,950	72.4	-0-	-0-	79,916	49,034
31	180,080	90,910	50.5	6,250	453	38,333	46,327
			TOTALS	282,895	28,581	1,142,206	941,456

a/ FERC Settlement Spill is spill requested by the Designated Representatives for juvenile salmonid passage. The volume of FERC settlement spill allocated for the 1982 season was 389, 170 CFS/Day (769,000 AF) at Rocky Reach Dam (includes supplemental quota).

b/ Federal Transferable Spill is spill for which the District received electrical energy from the federal system equivalent to the amount that Rocky Reach Dam could have produced with the volume of water spilled. This spill was shifted from federal dams Rocky Reach in order to improve juvenile fish passage at dams where the migration was passing and to reduce dissolved gas levels in the lower Columbia River.

16-30 April. Spills of greater than 20% prevailed from 1-15 May except for 11, 12, and 13 May. By order of the FERC, the spillbay caisson was removed from the spillway area, which necessitated stopping spill for 10 hours on 11 May, and 9 hours on 12 May. Spill was stopped for 6 hours on 13 May to raise the forebay pond elevation to optimize conditions for a fish release at the Turtle Rock hatchery. Spill was greater than 30% of the daily average flow from 16-31 May, with 13 of those days having spills greater than 40%.

The 1982 Rocky Reach migration monitoring program consisted of hydroacoustic arrays in the powerhouse area, tailrace seagull counts, and gatewell dipnet samples. Overall timing from gatewell samples is shown in Figure 4.

The hydroacoustic apparatus was in operation from 19 April through 24 May and from 14 June through 12 July. The daily smolt index data was generated during a study of smolt vertical and horizontal distribution conducted by Biosonics, Inc. The index is expressed as the daily average number of fish per minute in front of various turbine units. Tailrace seagull counts were made three times daily and averaged. Fish sampled from gatewells were taken from the gate slot removing all available fish from the slot once daily during the peak of the migration and less often before 19 April and after 21 May.

In general, these monitoring methods indicated few fish were present prior to 15 April, with a rapid increase in numbers from 16-19 April. Fish numbers remained at high to moderate levels through 20 May, then declined rapidly. The spring migration was essentially finished by 31 May. Hydroacoustic monitoring indicated a relatively stable fish passage rate from late April through late May with one bump in the curve following fish releases from the Turtle Rock Hatchery, located 1 3/4 miles upstream on 5 and 13 May. Gatewell dipnet samples showed that the majority of the spring chinook and steelhead migrants passed Rocky Reach between 19 April and 15 May, coho between the 5 May release and 15 May, while the sockeye migration peaked between 21 and 28 May.

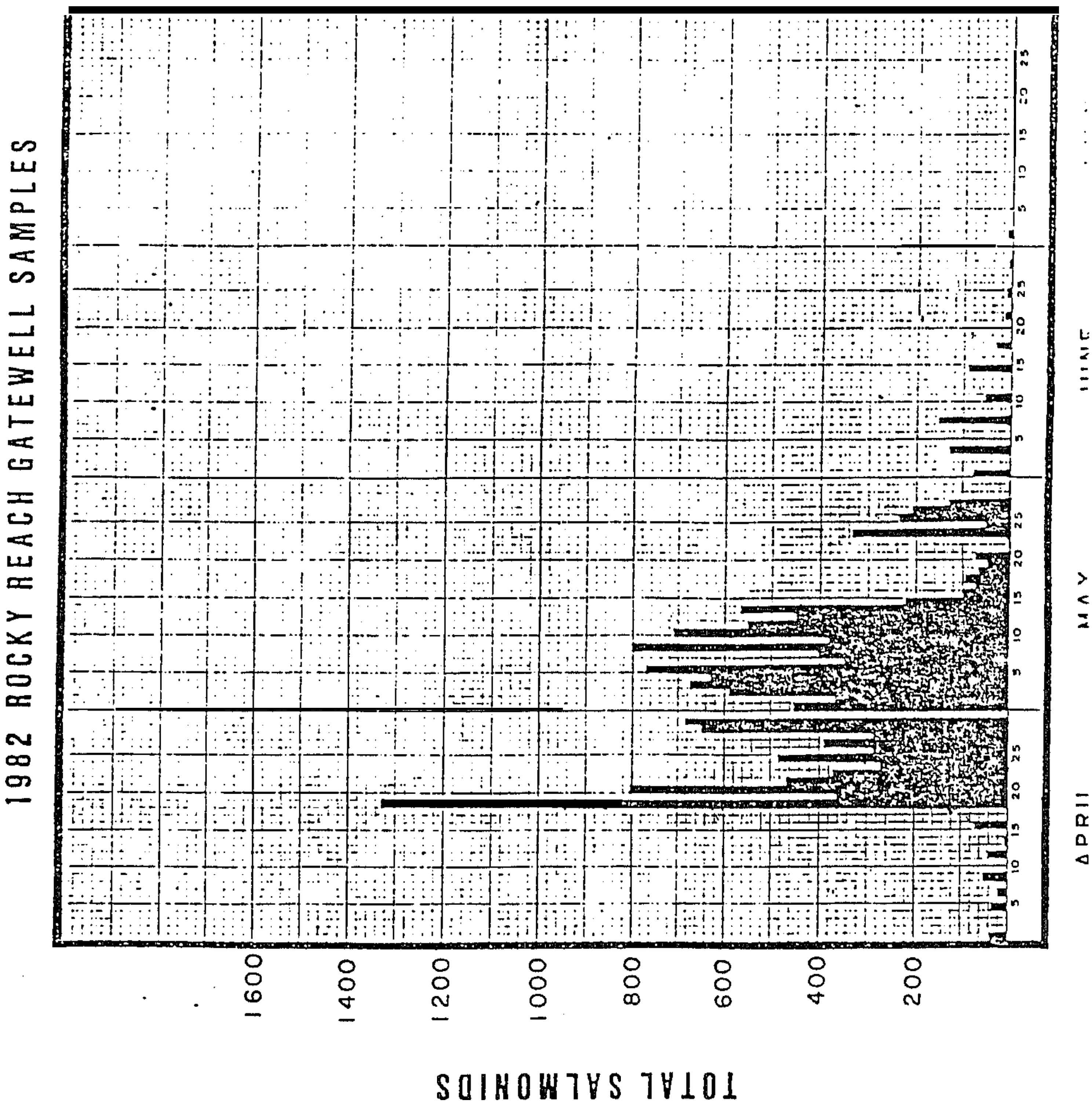


Figure 4. Number of juvenile salmonids removed from Rocky Reach Unit 1 gatewell A during the 1982 migration. (Source Chelan PUD.)

Subyearling summer chinook migrants began appearing in the gatewell samples on 4 June and small numbers were captured until 18 June; very few chinook were taken after 18 June and gatewell samples were discontinued on 2 July. Hydroacoustic data indicated moderate levels of summer migrants during the same period, then an increase in numbers began after 2 July and fairly high indices were recorded through the remainder of the study, which concluded 12 July. Based on the size and appearance of the summer migrants taken from the gatewells in early June, it was concluded that those early fish were primarily from the Wells hatchery and represented the larger individuals from that release. The wild migrants and probably the majority of the Wells Hatchery release were just starting to migrate past Rocky Reach in early June.

Rock Island Dam

Spill timiny and quantities were determined by the Designated Representatives (one utility District biologist and two fishery agency biologists). The Designated Representatives consulted with the Smolt Coordinator to make best use of the system transfers of forced spill and shape the spill program to match the fish migration by providing the highest quantities and most' hours of spill during peaks in fish abundance. At times when considerable system forced spill was available, the Designated Representatives worked with the Smolt Coordinator to control gas supersaturation while maintaining optimal downstream fish passage conditions.

The optimal spill configuration for fish passage at Rock Island, as determined by concensus of the Designated Representatives based on the available evidence, consisted of one or two deep gates open full (20,000 cfs per gate) adjacent to the second powerhouse and one deep gate spilling 10,000 cfs on the first powerhouse side of the river. If spill volumes exceeded 50,000 cfs, the additional spill was divided between the second powerhouse channel and the first powerhouse channel in the same ratio as the proportion of total turbine discharge attributable to the respective powerhouse. The primary spill gates used during the season were gates 30 and 31 adjacent to the second powerhouse and gate 3 or 4 near the first powerhouse. When these gates were fully open, additional spill was distributed between various deep or shallow gates equipped with automatic controls, primarily in the second powerhouse channel. Early in the season, when limited spill was available, most spill took place during the period of peak fish passage, from 2000 to 0600 hours. After 5 May a minimum spill volume of 50,000 cfs was maintained throughout the day.

Due to system spill and energy transfers, a spill accounting system was developed to avoid depleting the FERC spill quota at times when system energy replacement spill was available. The FERC Order quota was used to provide spill at times when insufficient federal system transferable spill was available, thus maximizing fish survival benefits. In addition, due to high river flows and limited turbine capacity, considerable forced spill occurred in excess of the level required for optimum fish passage. Spill accounting is summarized in Table 5.

The FERC Order spill quota, based on the 1 April yearly runoff forecast and operation of the first powerhouse was 658,998 acre-feet, plus an additional 100,000 acre-feet of supplemental volume since the fish migration lasted more than 30 days. The Rock Island spill program utilized 809,218 acre-feet, or 107% of the quota, which resulted in energy losses of 16,351 MWH. The FERC spill quota was used from 17 April throuyh 26 May. System energy replacement spill amounted to 4,482,215 acre-feet during the period from 16 April through 31 May, and continued to occur through June and into July for purposes of dissolved gas abatement. Forced spill from 16 April through 31 May was 260,130 acre-feet. Total spill at Rock Island during the spring juvenile salmonid migration (16 April-31 May) was 5.551.562 acre-feet.

Rock Island spill volumes ranged from 10.8% to 59.3% of the daily average flow during the 17 April through the 31 May period. Spill averaged 23% from 16-30 April, 48% from 1-15 May, and 39% from 16-31 May. Spill averaged 36.5% for the period 17 April to 31 May 1982, and can be compared to the average of 5.7% for the same period in 1981.

Table 5.--Rock Island Dam Spill.

Date	Daily stream flow (CFS)	Daily spill (CFS)	%Stream flow spilled	FERC[a] Settlement spill (CFS)	Energy foregone (MWH)	Federal[b] transferable spill (CFS)	Forced spill (CFS)
April							
16	176,100	-0-	-0-	-0-	-0-	-0-	-0-
17	168,600	21,400	12.7	7,758	404	13,642	-u-
18	178,300	24,500	13.7	7,783	390	16,667	50
19	186,700	20,100	10.8	9,738	498	10,362	-0-
20	155,900	20,1UU	12.9	7,646	409	2,083	10,371
21	148,800	37,100	24.9	-0-	-0-	37,100	-0-
22	141,600	53,300	37.6	-0-	-0-	53,300	-0-
23	140,630	32,890	23.4	1,492	72	30,833	565
24	122,410	68,320	55.8	-0-	-0-	68,320	-0-
25	113,910	30,860	27.1	-0-	-0-	29,130	1,730
26	128,010	23,060	18.0	3,033	164	20,027	-0-
27	130,530	38,150	29.2	1,683	78	29,166	7,301
28	131,180	40,690	31.0	16,000	710	24,690	-0-
29	117,810	18,260	15.5	18,260	1,048	-0-	-0-
30	130,470	17,550	13.6	1,190	67	6,563	9,797
May							
1	126,010	66,180	52.5	-0-	-0-	59,809	6,371
2	153,180	79,510	51.9	-0-	-0-	79,393	117
3	168,050	45,610	27.1	9,663	424	34,514	1,433
4	162,100	68,800	42.4	12,508	432	54,580	1,712
5	159,940	89,490	56.0	10,388	282	78,654	448
6	160,410	91,160	56.8	8,292	223	82,504	364
7	156,850	89,430	57.0	10.558	274	78,633	239
8	179,200	100,000	55.8	-0-	-0-	99,829	171
9	180,800	101,400	56.1	-0-	-0-	100,000	1,400
10	183,400	68,200	37.2	29,575	1,107	33,583	5,042
11	163,700	59,500	36.3	25,854	999	33,192	454
12	158,300	67,700	42.8	16,721	622	47,917	3,062
13	160,200	77,700	48.5	21,308	711	56,054	338
14	146,600	67,000	45.7	15,250	556	51,150	600
15	162,300	96,200	59.3	1,654	44	93,488	1,058
16	172,600	100,200	58.1	-0-	-0-	99,963	237
17	188,800	74,500	39.5	10,362	405	63,529	609
18	184,300	83,400	45.3	18,833	651	62,258	2,309
19	197,100	53,800	27.3	16,379	743	37,150	271
20	198,100	88,400	44.6	10,417	360	70,354	7,629
21	194,410	80,960	41.6	12.371	448	64,450	4,139
22	185,740	68,060	36.6	33,450	1,333	33,367	1,243
23	191,540	85,000	44.4	-0-	-0-	76,942	8,058
24	196,520	67,680	34.4	37,597	1,533	24,992	5,109
25	194,600	73,880	38.0	16.588	645	45,833	11,459
26	197,520	55,080	27.9	16,363	719	24,700	14.017

Table 5.--Rock Island Dam Spill (continued).

Date	Daily stream flow (CFS)	Daily spill (CFS)	%Stream flow spilled	FERC[a/] Settlement spill (CFS)	Energy foregone (MWH)	Federal[b/] transferable spill (CFS)	Forced spill (CFS)
27	189,500	51,660	27.3	-0-	-0-	41,454	10,206
28	200,700	58,620	29.2	-0-	-0-	45,833	12,787
29	184,290	93,570	50.8	-0-	-0-	93,570	-0-
30	183,150	100,540	54.9	-0-	-0-	100,000	540
31	182,950	54,310	29.7	-0-	-0-	54,167	143
TOTALS		2,803,820		408,696	16,351	2,263,745	131,379

a/ FERC Settlement Spill is spill requested by the Designated Representatives for juvenile salmonid passage. The volume of FERC settlement spill allocated for the 1982 season was 384,109 CFS/Day (758,998 AF) at Rock Island Dam (includes supplemental quota).

b/ Federal Transferable Spill is spill for which the District received electrical energy from the federal system equivalent to the amount that Rock Island Dam could have produced with the volume of water spilled. This spill was shifted from federal dams to Rock Island in order to improve juvenile fish passage at dams where the migration was passing and to reduce dissolved gas levels in the lower Columbia River.

The hydroacoustic array was operating from 13 April through 23 May during a study of smolt vertical and horizontal distribution conducted by Biosonics, Inc. A daily smolt passage index, expressed as the daily average number of fish per minute recorded in front of two turbine units, was developed during the study. The second powerhouse fingerling bypass system was sampled and the daily fish passage was estimated during a study conducted by CHZM Hill. Tailrace seagull counts were made three times daily and averaged. Timing by species as indicated by the bypass sampling, is shown in Figure 5.

The migration monitoring programs generally indicated few fish present prior to 15 April, then numbers of fish increased sharply for the next five days as a major migration of spring chinook smolts passed the dam. Fish passage rates continued at moderate to high levels through the rest of April and early May. Fish passage indices increased after May 10 as coho from the Turtle Rock Hatchery passed Rock Island Dam. The spring yearling smolt migrations had declined by 28 May and indices remained low until mid-June. A small increase in seagull counts about 10 June reflected the passage of chinook fry (40-50 mm fork length), presumably from the Wenatchee River. The fingerling bypass samples indicated peak migration dates of 23 April for yearling chinook, 18 May for steelhead, and 20 May for coho salmon. The sockeye migration was bimodal with those from the Wenatchee system passing between 25 April and 5 May and those from the Okanogan between 22 May and 30 May.

Priest Rapids - Wanapum Dam

Spill began 26 February at Priest Rapids and Wanapum dams and continued throuyh 31 July. Federal transferable spill from BPA was provided at at Priest Rapids from 12 April through 17 July and from 15 April though 17 July at Wanapum Dam. to assist in control of dissolved gases and to improve survival of downstream migrants. The combined high flows and spill transfers resulted in an unusually high percent of total water spilled at night when most juveniles were migrating. During the major smolt migration 2 May to 29 May, the percent spill to total discharge between 2200 and 0600 hours each night averaged 79% and varied from 60%

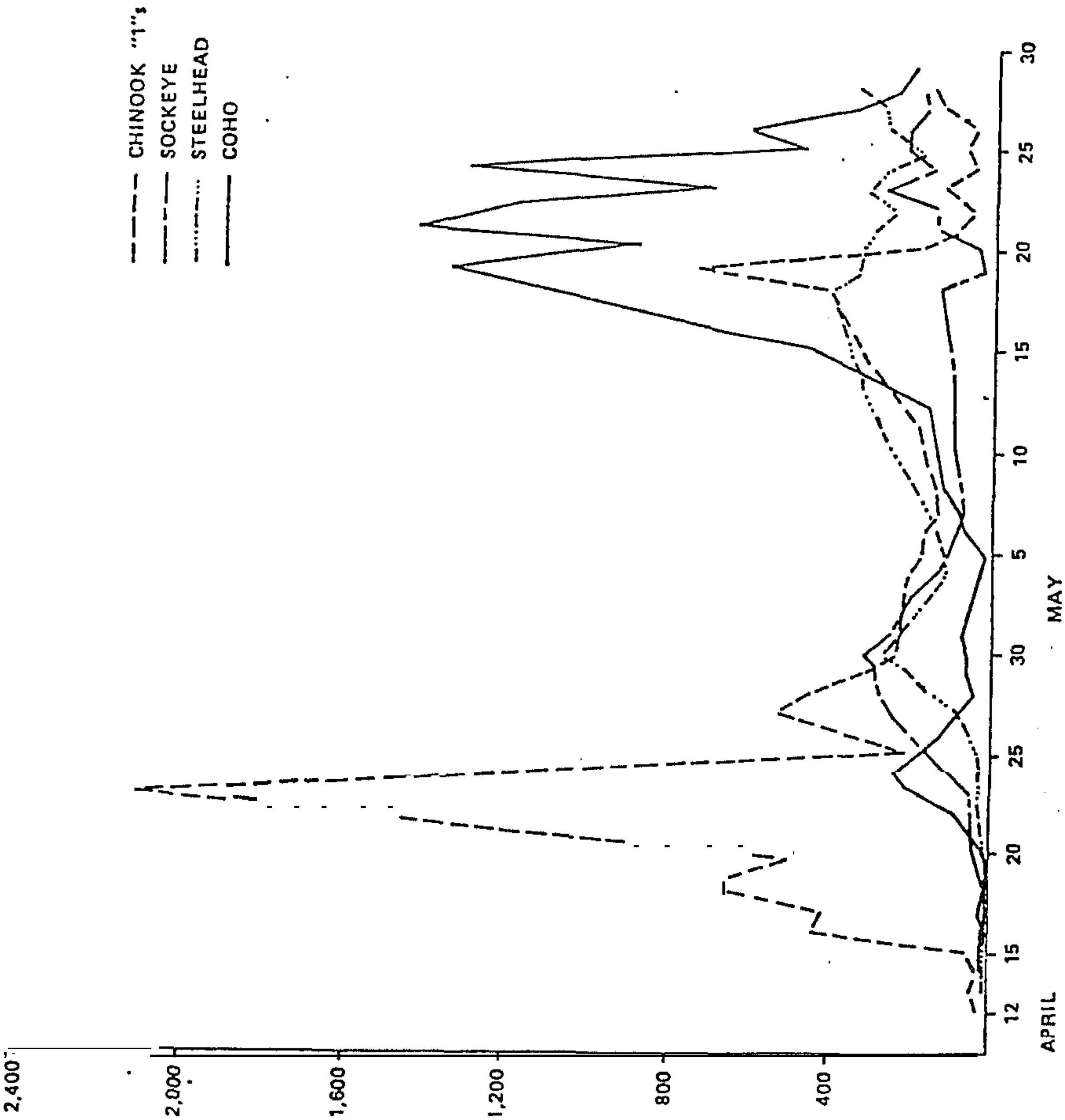


Figure 5. Estimated number of juvenile salmonids using the Rock Island fingerling bypass during the 1982 spring migration. (CH2M Hill. 1982).

to 85% as indicated below.

	61-65%	66-70%	71-75%	76-80%	81-85%
Number of days	4	1	2	7	13

The high spill (over 80% during half of the outmigration) should have provided better protection to migrants than in previous years. By comparison the period 2 May to 29 May in previous years, the percent spilled between 2200 and 0600 hours each night averaged 23% in 1981, 13% in 1980, and 10% in 1979.

At Wanapum Dam the spill averaged 58.9% of the discharge in the month of May 1982, and can be compared to the average of 12.3% for May 1981.

At Priest Rapids Dam the spill averaged 63.7% of the discharge in the month of May 1982 and can be compared to the average of 12.3% for 1981. The heavy spill encountered in 1982 caused damage to hydroacoustic gear at Priest Rapids in early May. On 4 May, spill gate 12 failed during heavy spill, slammed shut, and was out of service for the remainder of the spill season. Gas saturation levels were monitored periodically from 24 April to 29 June. These levels measured in the Priest Rapids forebay ranged form 106 to 128%. See Section IV for additional detail on dissolved gas monitoring.

Fish were sampled in gatewells daily at Priest Rapids by Parametrix and District personnel from 23 April to 4 June. Eight selected gatewells at Priest Rapids were used for indexing juvenile smolt migrations, and study plans were coordinated through the FERC Studies Committee. A reduced sampling effort continued into September (3 to 5 days per week).

Seagull counts were recorded for 0800, 1200 and 1700 hours from 15 April through 30 June as indicators of smolt passage. Peaks in gull observations occurred on 29 April and 5, 19, 23 and 27 May.

Migrations of yearling smolts began passing the two dams during the last week in April, peaked between 4 and 16 May, and were generally completed by 4 June. Approximately 80% of the migration passed between 2 May and 27 May. Timing of the spring migration by species as related to river flows and spill is shown in Figure 6. The timing of the juvenile chinook salmon migration was a single mode with peak numbers between 1 and 6 May. One group of steelhead passed in early May and a second around the 14th to 16th of May. Migrations of sockeye salmon were also bimodal. The first peak (probably mostly Wenatchee River) occurred in the first week in May and the second, (mostly Okanogan River), between 24 and 28 May. Coho salmon released from Turtle Rock failed to show at either Wanapum or Priest Rapid Dam.

Lower Snake River Projects

Lower Granite and Little Goose Dams

All six turbines were in service at both dams. Traveling screens were installed and trash racks were raked in all units at Lower Granite Dam by 1 April, and collection facilities were operational by 4 April; juvenile counting facilities were activated on 6 April by NMFS. A new wet separator was installed and the diameter of the hose to the barge was increased to 10 inches. The TV camera was again used to inspect traveling screens at both dams for signs of wear. Additional details on new installations and operations of the collection systems are contained in Section IV Juvenile Collection and Transportation.

River flows were about 75,000 cfs on 1 April, rising gradually to over 100,000 cfs by 13 April, and remained between 100,000 cfs and 120,000 cfs through 15 May. By 19 May, flows had increased to 165,000 cfs and remained above 135,000 cfs through 29 May. Maximum flow during the smolt migration was 186,000 cfs on 27 May. Flows declined in early June, dropping to 102,000 cfs on 16 June. Flows then increased sharply reaching 206,000 cfs by 18 June. Flows remained above 160,000 cfs throuyh 2 July, then declined rapidly, reaching 75,000 cfs on 17 July and 29.000 cfs on 1 August. The hiyh flows resulted in large amounts of trash accumulating on the upstream faces of these dams.

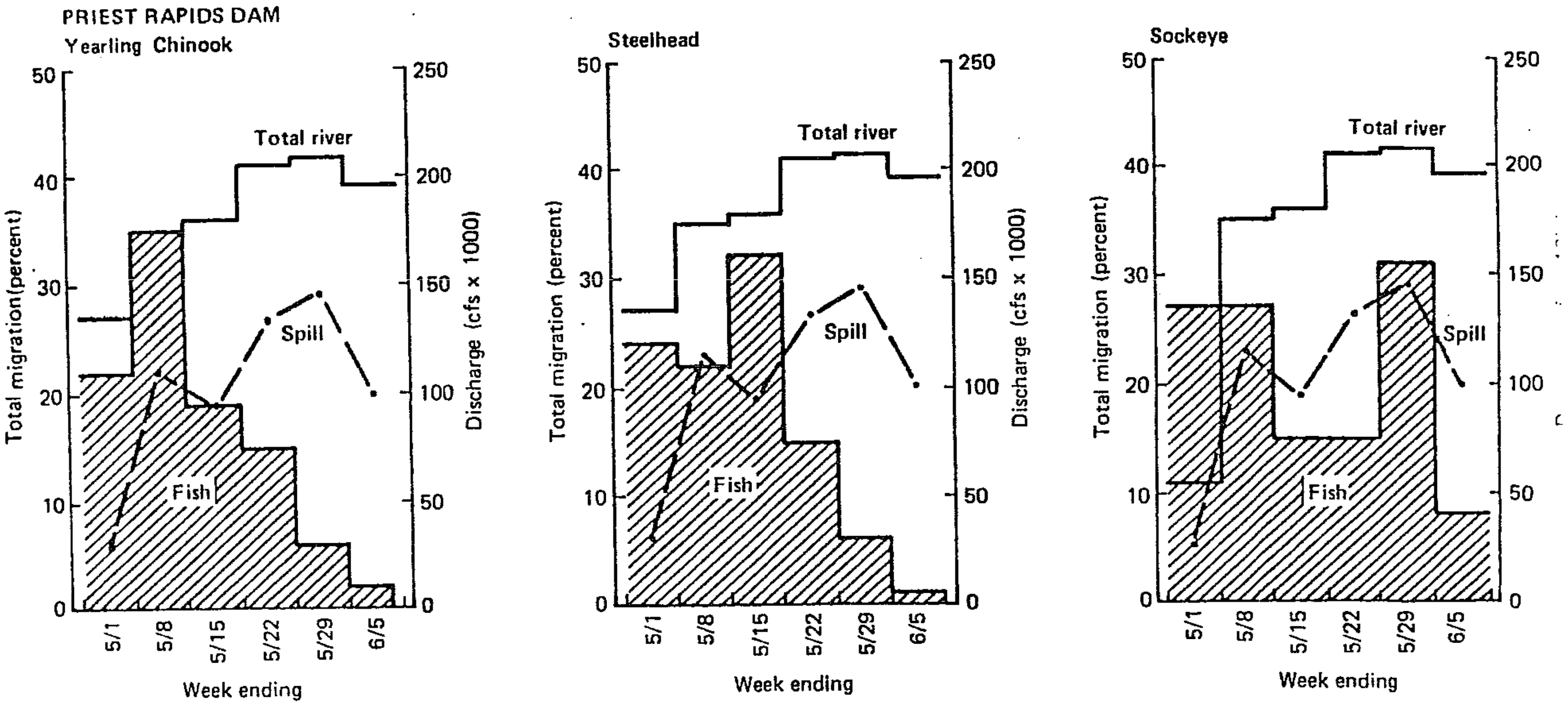


Figure 6.--Timing of yearling chinook and sockeye salmon and steelhead in relation to total river discharge and spill at Priest Rapids Dam, 1982 (source NMFS).

Spill of approximately 20% at both dams commenced on 17 April and continued throuyh most of the smolt outmigration period even though powerhouse capacity was not exceeded. The request to spill came from the fishery agencies (see Appendix 2). The purpose was to improve survival of chinook downstream migrants by providiny passage with high levels of spill and flows. The second reason for spill at the collector dams was to provide greater flexibility; in shaping spill for control of gas supersaturation. The percentage of water spilled at Lower Granite Dam between 2200 and 0600 each night (the period when most migrants are collected), ranged between 26% and 45% and averaged 27% between 17 April and 31 May. There was no spill during the nights of 1, 2, 3, 10, 12 and 13 June. Flows and levels of spill then increased sharply and spill averaged 38% through 2 July. There was no spill after 6 July. Comparable spill at night occurred at Little Goose Dam. A total of 5,937,00 AF was spilled at Lower Granite, and 5,663,000 AF was spilled at Little Goose.

Smolts began to appear on 2 April and collection began on 6 April at Lower Granite Dam, and 9 April at Little Goose Dam. Timing of the yearling and subyearling chinook salmon and steelhead migrations as related to flows and spill in 1982 is shown in Figure 7. The yearling chinook salmon migration was earlier with the peak occurring on 29 April and 90% passage by 17 May. Steelhead peaked about 11 days later on 10 May with 90% passage by 31 May. Subyearling chinook salmon began migrations on 23 May with 80% of the migrations passing between 14 June and 4 July and the peak of migration on 30 June. Significant levels of spill occurred during the migrations of all three groups of fish, especially for subyearling chinook salmon. Similar timing of migrations was noted at Little Goose Dam.

Additional details on transportation activities, river flows are related to numbers of smolts collected, and project operations at Lower Granite and Little Goose Dams may be found in Section IV.

Lower Monumental Dam

The Walla Walla District provided sonar monitoring on a daily basis from

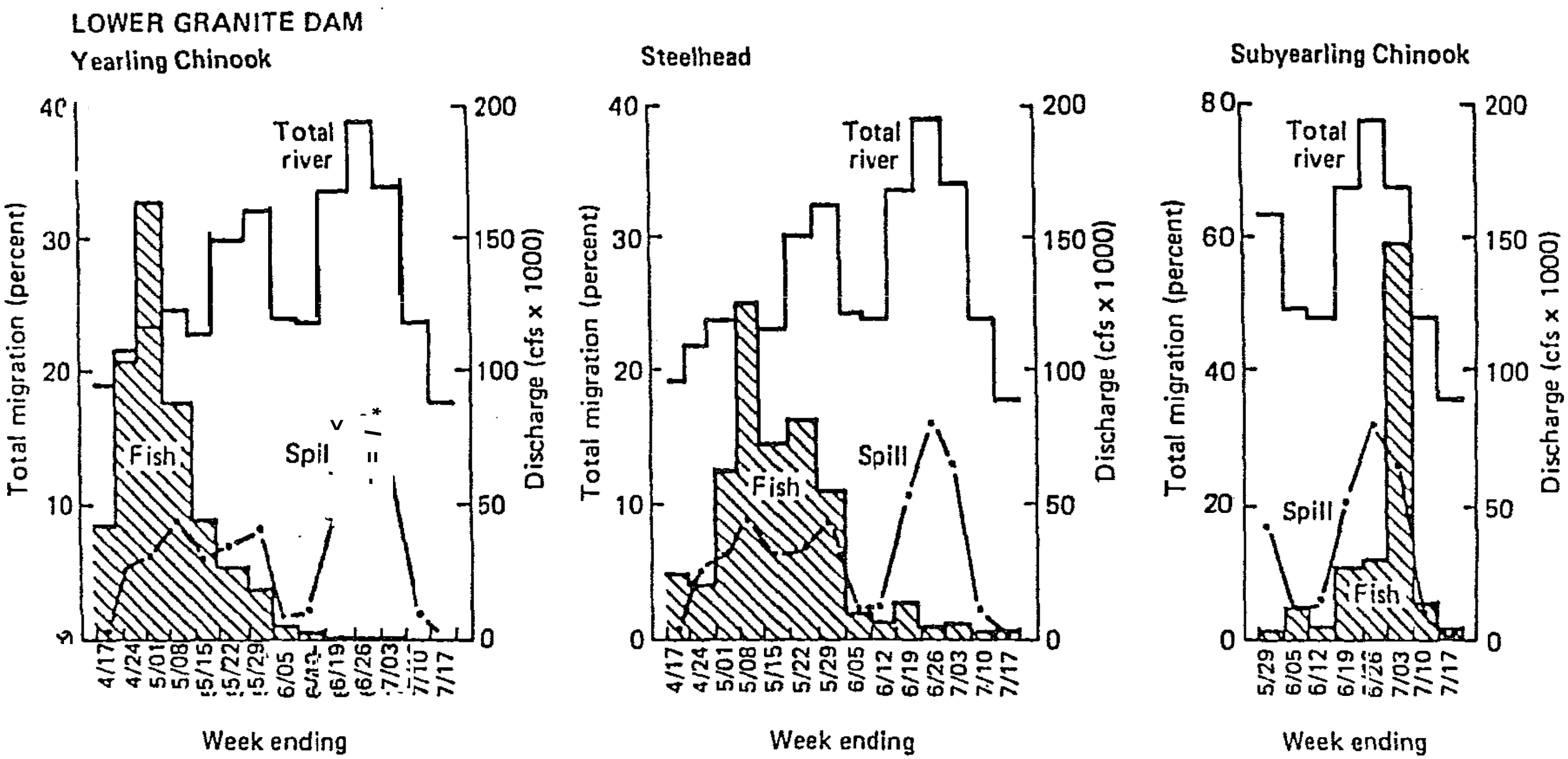


Figure 7.--Timing of smolt migrations in relation to total river discharge and spill at Lower Granite Dam, 1982 (source NMFS).

1700 to 2300 hours at Lower Monumental Dam beginning 19 April. Sonar monitoring was terminated the evening of 22 May due to the continuous forced spill. Two scanning sonars were utilized with the transducers located at the north and south ends of the powerhouse. This provided coverage of the entire powerhouse, the first four spillbays next to the powerhouse, and 300 feet of the nonoverflow section near the opposite end of the powerhouse. The stoplogs placed in Spillbay 7 to provide surface spill at Lower Monumental Dam in 1981 were removed because of problems with twisted cables, and the fishery agencies' belief that the deep spill was more effective. Fish passage spill was provided by using bays 7 and 8. Because of the high flows in the Columbia and Snake Rivers, surplus water was available so the COE requested Lower Monumental spill a minimum of 20,000 cfs from 2000 to 2400 hours nightly, beginning 8 April. Lower Monumental experienced forced spill from 17 February through 26 March, 28-29 March, and 2, 4, and 5 April prior to the requested nightly minimum spill. There was forced spill during all or most of the day from 16 April through about 0600 hours 19 July. There was spill again the nights of 21 and 22 July. Forced spills reached a maximum of 183,000 cfs for 5 hours the morning of 24 June.

With so much spill throughout the system, dissolved gas levels were a major concern. Every effort was made to keep as much load as possible on the powerhouse at Lower Monumental to control the gas levels and to improve adult passage conditions.

On 30 April the fishery agencies requested Lower Monumental provide a minimum spill of 40,000 cfs. This request was in effect unit1 4 June. In addition, on 6 May the agencies requested that the minimum spill be increased to 80,000 cfs each night from 2000 to 0600 hours with 40,000 cfs minimum all other hours. On 4 June, the minimum spill request was terminated on 19 July, but on 21 July the COE requested the project provide 6 hours of 30,000 cfs spill at night for fall chinook passage since water was available. This spill was terminated on 23 July because juvenile counts were low. In spite of the efforts to control dissolved yases by limitiny spill. the generation was reduced to zero and the entire flow spilled for a few hours at night, 24 through 30 June. A total of 14,999,000 AF was spilled at Lower Monumental.

Ice Harbor Dam

The Walla Walla District modified the ice and trash sluiceway at Ice Harbor to permit the flow to be increased from the 400 cfs used in 1981 to 2,000 cfs. The sluiceway was to be used as the primary juvenile bypass with spill to be provided based on evaluation of sluiceway effectiveness. The Walla Walla District contracted with Biosonics Inc., to monitor the juvenile movement through the sluiceway. Two days a week the district checked the sonar counts by use of a fyke net in the sluice gate slot. Sonar monitoring of the sluiceway entrances was terminated on 28 May after a week of limited migration activity.

The sluiceway was operated form 12 April through 20 August. However, because of the wet spring and high flows in the Snake River, Ice Harbor had continuous forced spill from 10 April through 7 July. The project had some spill each day through 18 July when the spill was terminated at about 2400 hours. Maximum hourly spill was 135,0000 cfs during 0600 hours, 16 May. On 6 May, the fishery agencies requested Ice Harbor provide a minmum spill of 40,000 cfs. This request was in effect through 3 June. A total 9,429,OOO AF was spilled at Ice Harbor.

Lower Columbia River Projects

McNary Dam

All units except Unit 1 and 14 were screened by the time juvenile collection operations began on 30 March. Fish were present at that time from an earlier unscheduled release of yearling fall chinook salmon from Ringold Hatchery. An earlier start was not possible as necessary work was being performed on the finyerliny bypass channel, wet separator and sampling system. Heavy spill at the project prior to 1 April provided passage for these miyrants.

The fishery agency position with regard to not maximizing collection at collector dams included McNary Dam. With high runoff, powerhouse capacity was exceeded through most of the smolt migration period and there were large quantities of forced spill.

Flows at McNary exceeded recommended optimum flows through the April-June period except for four days in May; 1 and 2 May when the agencies agreed to delay until Monday 3 May the increase to 290,000 cfs, and 7 and 14 May when the daily average flows were 2,000 and 3,000 cfs less than the requested flow, respectively. Because of the high flows experienced during the April-July period, McNary had forced spill every day from 1 April through 18 July except for four days, 3, 9, 10 and 11 April. The average percent of total discharge spilled each night ranged from 19% to 60% and averaged 41% through the major portion of the spring smolt migration in the month of May. A ccnnparable average spill of 11% occurred in May of 1981.

Timing of yearling chinook salmon and steelhead migrations as related to flows and spill at McNary Dam is given in Figure 8. Approximately 80% of the yearling chinook salmon passed between 2 May and 22 May, and 50% of the migration passed in a 7 day period between 9 May and 15 May. The migration of steelhead was over a longer period 27 April to 25 May with no major peaks of migration. The sockeye salmon migration was bimodal with an early peak (mostly from the Wenatchee River) between 4 May and 13 May and a second peak (mostly from the Okanoyan River), between 24 May and 3 June. Most of the coho salmon passed between 19 May and 24 May. Additional information on project operations, transportation and collection activities, special studies, numbers, and survival of smolts may be found in Section IV.

John Day Dam

The COE expanded the spill research program at John Day Dam again in 1982 in an effort to resolve the conflicting or inconclusive results obtained fra the monitoring during the previous three years. These previous years' findings raised questions as to how the juveniles passed the

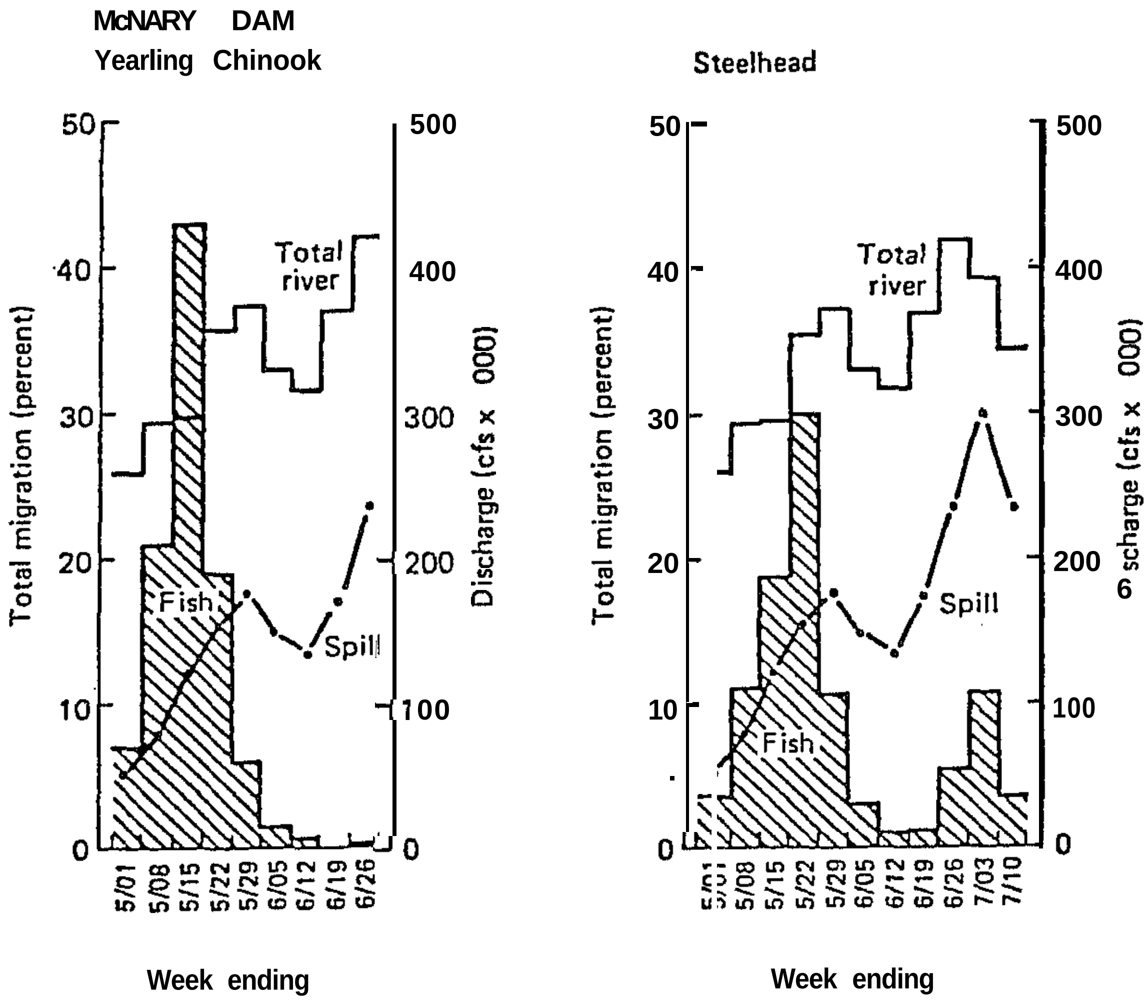


Figure 8.--Timing of yearling chinook salmon and steelhead migrations in relation to total river discharge and spill at McNary Dam, 1982. (Source: NMFS)

project and the effectiveness of spill and powerhouse operations for passage of juvenile fish. The Portland District purchased additional fixed aspect sonars to provide greater monitoring capability at both the powerhouse and spillway.

A total of 14 transducers were deployed across the powerhouse and spillway. Six transducers, one in each unit, were located in powerhouse units 1, 3, 7, 10, 14 and 16 during the majority of time during the migration. Transducers were initially deployed at spill bays 16 through 20, located approximately 10 feet above the floor of the intake and about 10 feet upstream of the spill gate. High velocities of water in this area posed mechanical difficulties which could not be easily overcome. The transducers were subsequently removed. Six transducers were relocated during 10-21 May, on the north and south pier-noses of spill bay 19. near the surface, oriented across the intake at 10°, 20°, and 30" angles up from the vertical to determine the most effective orientation for sampling one bay with a single transducer. By 4 July, spill bays 14, 16, 18, 19, and 20 were each instrumented with one transducer on the south pier oriented 30° up from the vertical. On 16 July, bays 3, 6 and 10 were added to the array using this orientation. Cables conducting signals to and from transducers were routed to a central monitoring station near Turbine Unit 16.

Index sampling by NMFS in Unit 3 provided hourly and daily passage estimates by species passing John Day Dam. (90% confidence limits = ± 5% for yearling chinook salmon ± 20% for steelhead --see Section IV for additional detail). Initiation of spill, determination of the number of hours to spill each night, and when to cease spill were based on CoE hydroacoustics monitoring and these hourly and daily passage estimates. As spelled out in the DFOP, nightly spill was to be initiated whenever daily smolt passage estimates exceeded 30,000 fish and continued until the daily estimates of smolts dropped below 30,000 fish.

With the high runoff, there was considerable forced spill in the system throughout the spring migration period. Spill requests for fish passage during the spring migration at John Day Dam that did not result in energy losses. Timing of the spring migration of yearling fish as related to flows and spill is shown in Figure 9. Over 80% of the migration passed between 1 May and 1 June with 50% of the migration passing between 7 May and 29 May.

Peak of migrations (all species) was 15 to 17 May (Table 6), about the same as 1981. Dates when 50% of the migration of yearling fish passed John Day Dam by species in 1982 compared to 1981, were 14 May vs 14 May (chinook salmon), 19 May vs 20 May (steelhead), 23 May vs 20 May (sockeye salmon), and 25 May vs 26 May (coho salmon). An April release of subyearling chinook salmon in the Umatilla River (just below McNary Dam) began showing at John Day Dam on 23 April, with peak passage days on 27-29 April. Most of these fish had passed the dam by 15 May.

There was continuous spill in May when the smolt migration was passing John Day Dam. The percent spilled ranged from 28% to 50%, and averaged 35% of the daily average river discharge in May. Spill was shaped some to provide a higher percentage at night when most of the smolt passage occurred, and a lower percentage during the day to enhance passage of adult fish. During May, the average percent spilled between 2200 and 0600 hours each night was 38% compared to 34% between the hours of 0700 and 2100 each day. The May 1982 spill averaged 35% and compares to similar values of 11% for 1981 (Figure 10).

Flows during May ranged from 273,000 cfs to 433,000 cfs and averaged 352,000 cfs. Except for 1, 2, and 3 May, river flows exceeded CRFC optimum flows.

Estimates of total passage at the powerhouse based on sonar observations are preliminary. Because 6 turbines out of a total of 16 turbines were monitored, there was a lack of data for a large portion of the powerhouse. Extrapolation was used to estimate passage at nonmonitored units. A preliminary analysis, using six operating turbines to represent 60% of an average of 10 operating turbines is shown in Figure 11. The total turbine passage estimate was 2,532,000 fish. of which 1,242,000 passed in May and 1,290,000 in June, July and August. Total smolt

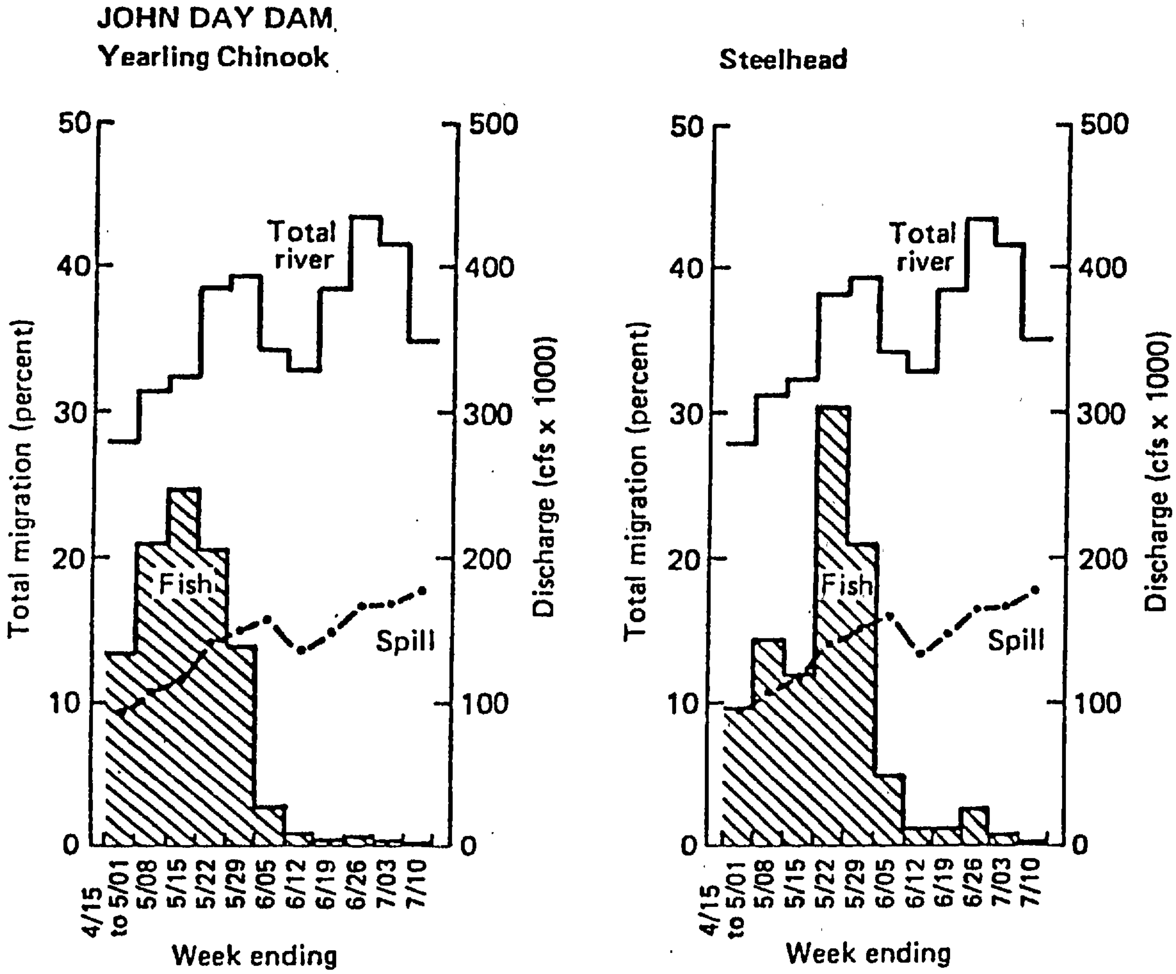


Figure 9.--Timing of yearling chinook salmon and steelhead in relation to total river discharge and spill at John Day Dam, 1982. (Source: NMFS)

Table 6.--Estimated daily passage of yearling smolts at John Day Dam, 1982 (developed from Unit #3 indices).

Date	Spring Chinook	Steelhead	Sockeye	Coho	Total	Cumulative total
4/15 to 4/25	191,337 10%	16,895	4,064	0	212,296	
4/26	10,582	12,985	8,348	0	31,915	
27	4,482	13,786	3,810	0	22,078	
28	11,299	24,687	4,520	0	40,506	
29	10,970	22,958	3,376	0	37,304	
30	4,589	7,903	1,329	0	13,821	
5/01	6,199	19,324	3,158	0	28,681 10%	386,601
02	17,129	20,815 10%	3,820	0	41,764	
03	12,188	11,366	3,778	U	27,332	
04	26,332	19,046	6,344	0	51,722	
05	134,203	32,294	10,000	52	176,549	
06	58,595	34,965	10,015	107	103,682	
07	86,931	29,177	26,138 10%	315	142,561 25%	930,211
08	40,132	26,345	24,818	0	91,295	
09	35,640	20,912	11,303	0	67,855	
10	64,368	22,461	25,543	0	112,372	
11	46,099	13,814	21,560	0	81,473	
12	94,645	26,628	20,884	0	142,157	
13	28,952	11,291	10,794	0	51,037	
14	40,860 50%	14,212	11,613	0	66,685	
15	129,078	38,819	18,597	113	186,607	
16	62,598	69,096	9,077	168	140,939 50%	1,870,631
17	110,071	64,076	13,759	0	187,906	
18	40,240	20,303	11,111	322	71,976	
19	49,029	61,770 50%	10,841	809	122,449	
20	29,011	33,954	10,110	523	73,598	
21	32,287	46,695	22,272	4,004 10%	105,258	
22	39,758	72,825	11,187	4,697	128.467	
23	51,933	64,536	14,004 50%	5,991	136,464	
24	46,107	31,812	8,768	4,805	91,492 75%	2,788,241
25	30.008	32,089	10,706	3,823 50%	76,626	
26	33,573	42,505	11,351	3,940	91,369	
27	26,273	29,807	35,632	5,806	97,518	
28	23,753	24,545	58,749	3,280	110,327	
29	33,542	30,014	19,624	696	83,876	
30	17,687	12,977	15,306	972	46,942	
31	6,747 90%	8,940	6,104	746	22,537	
6/01	13,054	17,939 90%	8,392	791	40,176 90%	3,357,612
02	3,231	8,204	13,510	677	25.522	
03	2,479	7,007	13,774	394	23,654	
04	3.002	9,753	9,321	339	22,415	
05	8,652	2,806	5,674	1,773 90%	18,905	
06	3,657	2,813	6,063	151	11,684	

Table 6.--Estimated daily passage of yearling smolts at John Day Dam 1982 (developed from Unit #3 indices) (continued).

Spring Date	Chinook	Steelhead	Sockeye	Coho	Total	Cumulative total
07	2,213	1,684	2,490	148	6,535	
08	3,123	3,238	4,925	429	11,715	
09	3,680	2,246	5,237	556	11,719	
10	2,574	3,106	3,346	414	9,440	
11	3,007	3,183	5,621	327	12,138	
12						
13						
14	4,974	3,577	4,719	228	13,498	
15	451	2,323	1,354	0	4,128	
16	813	3,712	650	0	5,175	
17	1,294	5,910	971	231	8,406	
18	842	2,159	337	0	3,338	
19						
20						
21	1,299	8,470	487	174	10,430	
22	906	5,238	725	0	6,869	
23	1,268	4,568	543	65	6,444	
24	4,212	8,122	733	65	13,132	
25	2,543	4,857	182	0	7,582	
26						
27						
28	5,643	5,629	1,328	119	12,719	
29	167	725	333	0	1,225	
30	162	529	0	58	749	
7/01	593	946	0	71	1,610	
02	198	645	0	0	843	
03	391	680	391	0	1,462	
04						
05						
06	1,091	553	909	909	3,462	
07	305	66	9,611 90%	0	9,982	
08	472	0	7,862	0	8,334	
09	148	0	2,222	0	2,370	
10						
7/11 to 9/10	9,013	878	50,114	0	60,005	
TOTALS	1,772,684	1,208,193	663,593	48,988	3,693,458	

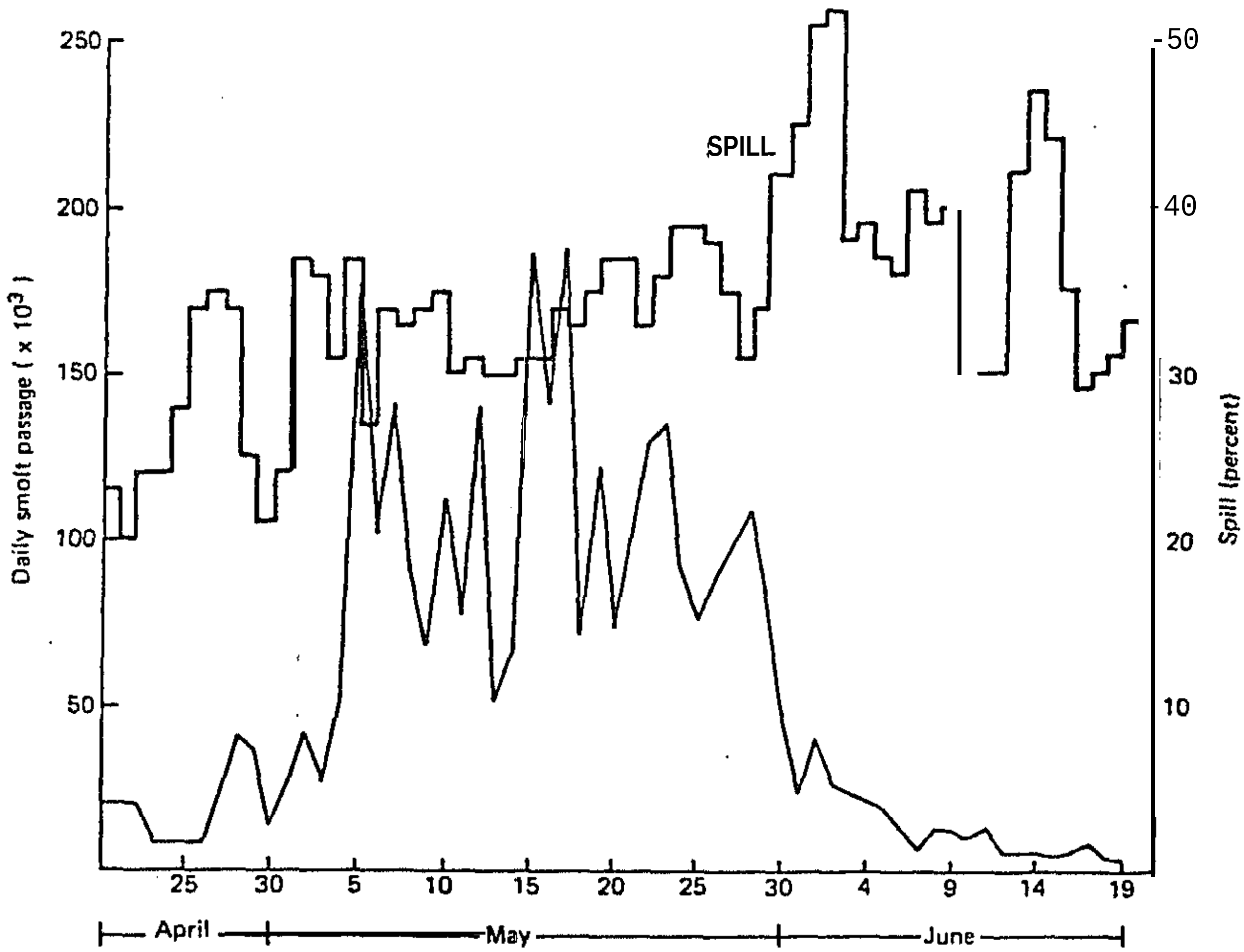


Figure 10. --Timing of smolt migration at John Day Dam in 1982 in relation to percent spill provided. (Source: NMFS)

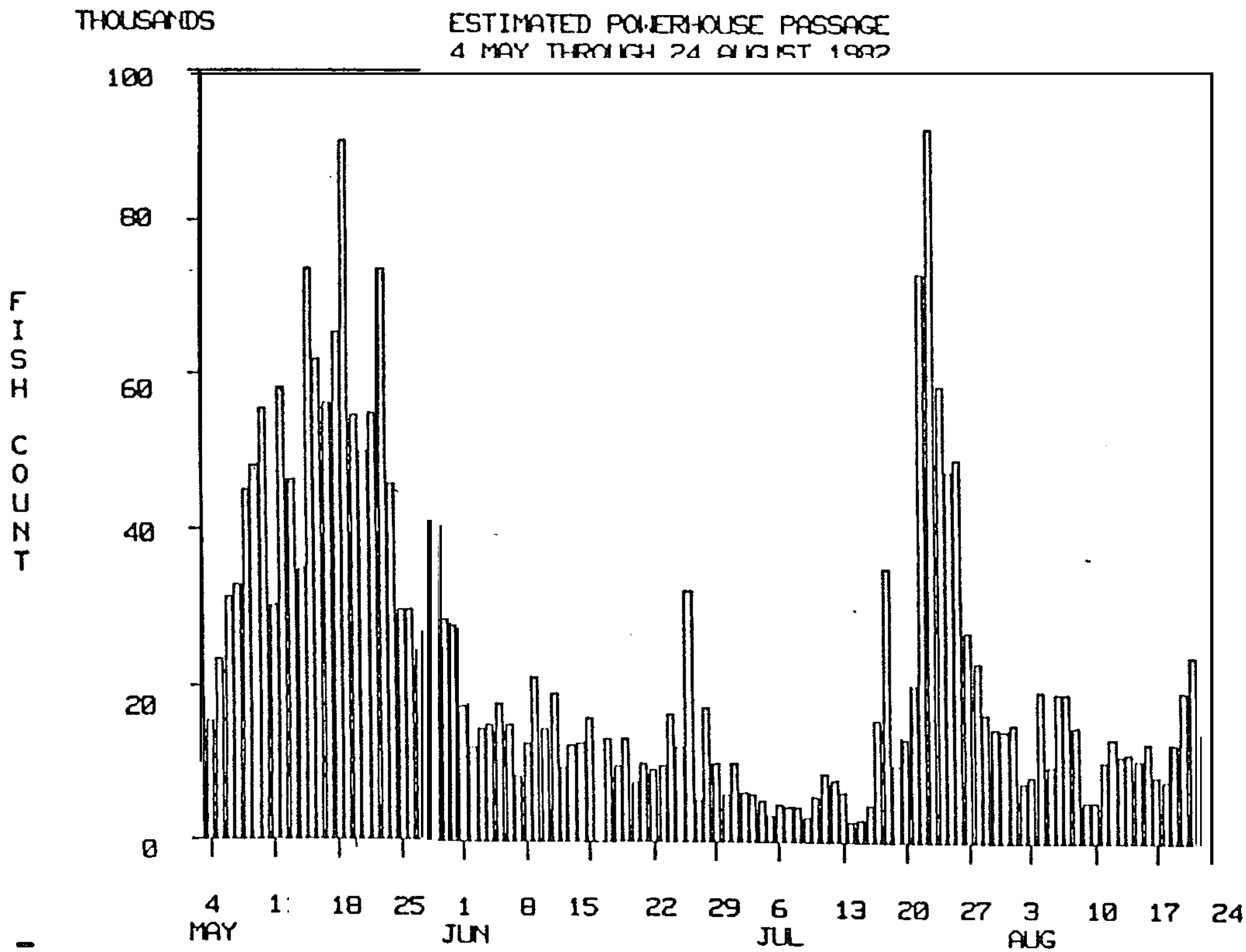


Figure 11--Estimated powerhouse passage of smolts each day from 4 May to 29 August based on hydroacoustics monitoring at John Day Dam in 1982. (Source: CofE)

passage (spill plus powerhouse) estimated from Unit 3 indexing for the month of May was 2,999,692 fish (all species combined). A hydroacoustic estimate of the horizontal distribution of fish passage among six turbines across the John Day powerhouse suggested that passage was skewed to the south end of the powerhouse with the greatest number of fish associated with Turbine Unit 1.

The hourly passage figures from Unit 3, together with the sonar observations, provided the means to determine how many hours to spill each night. The data from both methods generally agreed. The data from Unit 3 indexing generally indicated high passage for about 3 hours, from 2000 through 2300 hours, early and late in the migration, and about 5 to 8 hours of passage, from 2000 through 0400 hours, during the estimated peak of the migration (Figure 12).

Estimates of the percent by hour of diel fish passage for twelve days of hydroacoustics sampling during the spring and summer migration showed that about 70% of the passage through the powerhouse was between 2000 and 0500 hours (Figure 13).

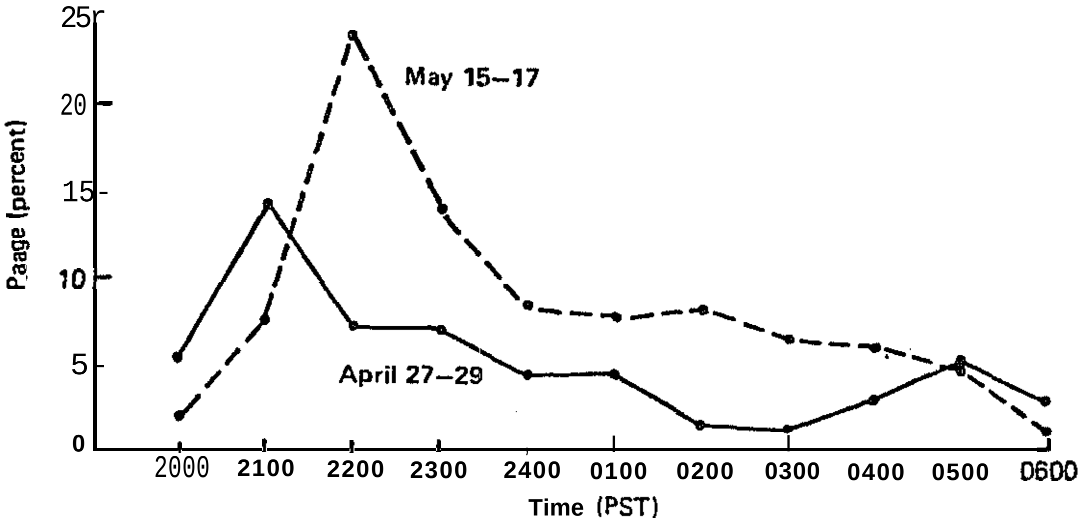
The NPD water quality section again monitored temperatures and total dissolved gas levels at the John Day Dam in 1982. Measurements began on 1 May, terminated on 12 May, and resumed again on 9 June. Total dissolved gas saturation averaged 115% in early May, 110% in early June, and rose to above 125% in late June when river flows and spill was highest.

Additional detail on the gas monitoring, magnitude, travel time, and survival of smolt migrations, and results of special studies conducted at the John Day project is contained in Section IV, FISHERIES.

The Dalles Dam

No voluntary spill was planned at The Dalles Dam for juvenile passage in the spring migration. The sluiceway was operated 148 days from 21 April through 31 August and 1-15 October. The sluiceway passed 3,600 cfs of

Figure 12.-- AVERAGE HOURLY PASSAGE OF YEARLING CHINOOK SAL MON THROUGH THE POWERHOUSE AT JOHN DAY DAM. (Source: NMFS)



JOHN DAY POWERHOUSE

Figure 13.--PERCENT BY HOUR OF TWENTY-FOUR HOUR PASSAGE FOR TWELVE DAYS DURING SPRING AND SUMMER 1982 (Source: CofE)

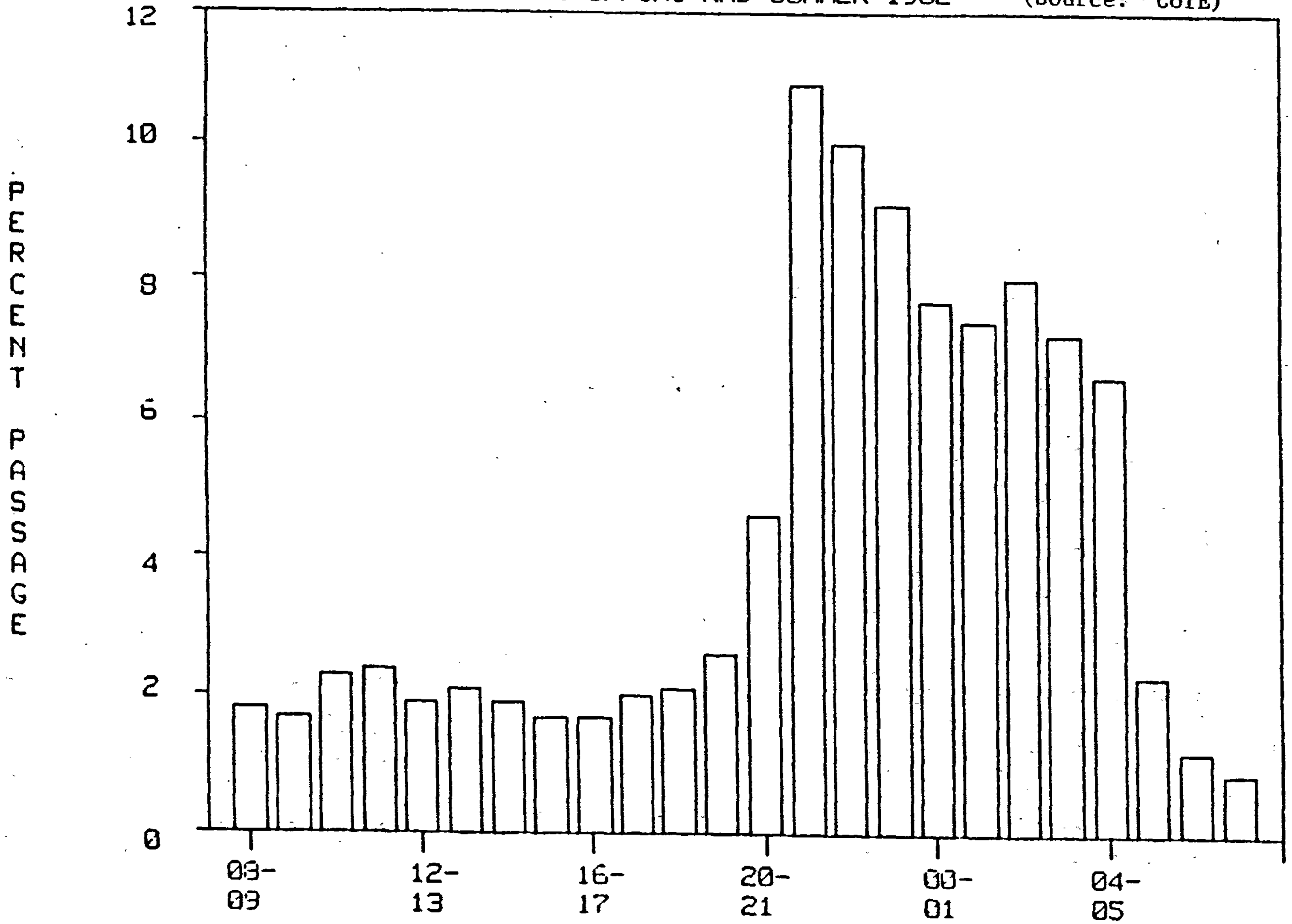


FIGURE 6

water for fish protection from 0600 to 2200 hours daily. A total of 704,500 AF of water was released through the sluice gates for juvenile passage. The orifice flow out of the gatewells averaged about 400 cfs and the orifices were open continuously using an additional 292,000 AF of water. Total flow through the sluiceway for the year was 996,500 AF. The Oalles Dam had forced spill of 20,346,000 AF between 2 April and 19 July, plus 73,000 AF of spill for 5 and 6 August. During May, daily average spill ranged from 34,000 cfs to 217,000 cfs, and averaged 97,000 cfs. The percent of total discharge spilled ranged from 10% to 52%. The 1982 average spill for the month of May was 29% and compared to an average of 6% for May 1981. Spill on 5 and 6 August was 18% and 9% of the total river discharge.

Bonneville Dam

No voluntary spill for juvenile passage was scheduled at Bonneville Dam since there is adequate spill during the spring outmigration even in low flow years due to the limited powerhouse capacity. Bonneville Dam was spilling continously from 16 February though 15 July. All units in the second powerhouse were screened when they came on line and the sluiceway in the first powerhouse was operated from 1 March to 31 October to protect juvenile migrants.

During the migration of yearling smolts in May, spill ranged from 59,000 cfs to 200,000 cfs and averayed 143,000 cfs. The percent of total river discharge spilled each day ranged from 21% to 51% and averaged 41% for the month of May. In 1981, the average spill for the month of May was 38%.

Summer Operations

Between 6 and 10 million wild and hatchery-reared fall chinook salmon originating between Priest Rapids and McNary Dams, and summer chinook salmon from the mid-Columbia generally start migrations in late May and continue their migrations through the summer. Timing of these subyearling chinook salmon migrations vary from year-to-year, but generally the peak periods of migration occur sometime in early August at Priest Rapid Dam and sometime between early July and early August at the lower Columbia River dams. Migrations began passing Priest Rapids Dam in early July with 80% of the migration passing between 17 July and 21 August, and 50% of the migration passing by 7 August. Spill averaging 21% provided protection to about half of the migration (Figure 14).

Migrants began passing McNary Dam in early June with 80% of those collected passing between 13 June and 23 August, and with 50% of those collected passing by 21 July (Figure 15.). Because of considerable variation in the amount of spill during the migration, numbers collected are not necessarily representative of actual timing. Spill in excess of 200,000 cfs occurred through 7 July. In early July, the percent of total discharge spilled occassionally exceeded 77%, and numbers of fish collected were small. Consequently, a major portion of the migration probably passed over the spill rather than being collected during this period. In contrast, there was no spill on 21 July when the largest numbers were being collected. Therefore, 50% of the migration probably passed in late June or early July, rather than the 21 July date shown.

Most of the fish collected at McNary Dam were transported below Bonneville Dam. Because of high spill, the 1.6 million fish hauled was less than the 2.1 million fish hauled in 1981.

A total of 6.6 million subyearling chinook salmon were estimated at John Day Dam in 1982. No estimates of sampling efficiency have been obtained on subyearling chinook salmon passing John Day Dam. Therefore no confidence limits can be calculated about the daily and annual passage estimates. These fish are not smolting and average 18 days to several months in travel between McNary and John Day Dam. Because of these delays and potential mortality. recovery rate of fish marked for measures of sampling efficiency are not really representative of actual passage at John Day Dam. Therefore the Unit 3 index expansion numbers for yearling chinook salmon have been utilized for measures of daily and annual passage of subyearling chinook. Similarity in rate of recovery of marked groups from yearling fish releases and faster moving subyearling fish

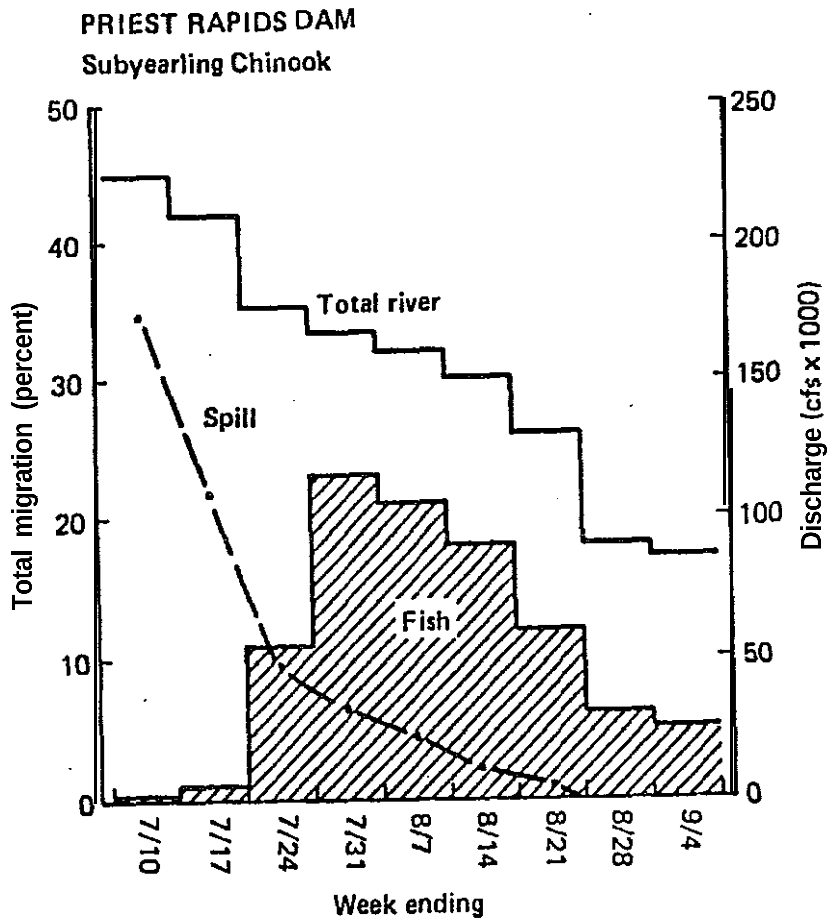


Figure 14.--Timing of subyearling chinook salmon migrations in relation to river discharge and spill at Priest Rapids Dam, 1982.

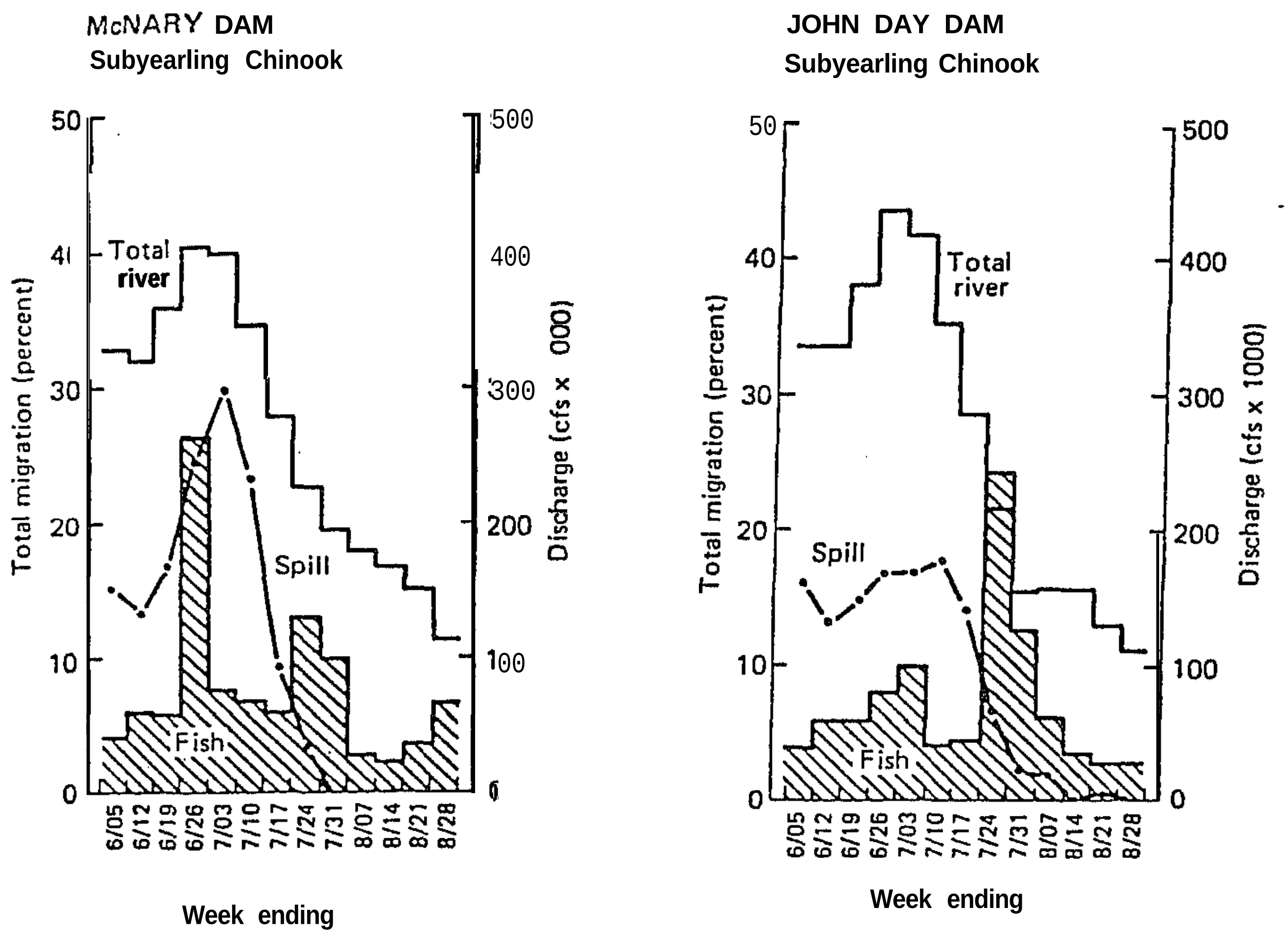


Figure 15.--Timing of subyearling chinook salmon migrations at McNary and John Day Dams in relation to total river discharge and spill, 1952 (source NMFS).

indicate that passage estimates for subyearling fish based on yearling fish expansion equations are realistic. At the very least they do provide an index of timing and relative abundance for spill management and for providing year to year measures of relative abundance of subyearling chinook salmon at John Day Dam. Fifty percent of the subyearling chinook salmon passed John Day Dam by 21 July, when forced spill ended with 80% of the migration passing between 11 June and 31 August (Table 7). An additional 636,000 subyearling migrants passed the dam between 1 September and 11 December. The percentage of forced spill through the first half of the migration ranged from 23% to 52% of the daily average discharge. Voluntary spill of 20% to 47% was provided for one to eight hours at night for an additional 14 days, and provided some protection to an additional 25% of the run.

The total of 8.2 million fish to the lower river (6.6 million at John Day plus 1.6 million transported from McNary Dam) was considerably larger than the 6.2 million fish in 1981 and 4.4 million fish in 1980.

Major Storage Reservoirs

In view of the above normal water supply forecasts, the water management agencies advised the fishery agencies in late March of their plans to aid this year's juvenile outmigration. The BR, BPA, and CofE modified the power marketing and flood control operations (in the month of April) to reserve some water in headwater reservoirs to augment flows if needed during the early part of the outmigration. Dworshak and Brownlee operations were modified to allow these projects to delay reaching flood control elevations until late April, thus providing some additional flow through April, in case the natural flows did not reach adequate levels. Grand Coulee was maintained at higher levels than normal to conserve water for fish flow augmentation.

The operating agencies agreed to provide special regulation for the spring smolt migration consistent with a balancing of potential impacts on other project purposes. Based on the mid-March water supply outlook, it appeared the recommended optimum flows in the Columbia could be nearly

Table 7.--Daily passage of O-age chinook salmon as related to the percentage of spill provided duriny the summer migration period at John Day Dam, 1982. (Numbers in parentheses refer to days that 10, 25, 50, 75, and 90% of the migration passed the dam.)

Date	Number of fish		% Spill (forced)	Date	Number of fish		% Spill (forced)	Fish spill %	Fish spill No. hours
	4,956		35	0713	36,154		46		
0526	5,911		31	0714	7,990		40		
0527	7,443		34	0715	13,095		39		
0528	4,036		41	0716	11,385		39		
0529	11,224		45	0717			39		
0530	20,562		51	0718			44		
0531	19,231		52	0719	300,397		31		
0601	36,417		39	0720	44,550		23		
0602	58,127		39	0721	216,501		9		
0603	58,768		36	0722	312,009	(50)		35	7
0604	34,184		36	0723	617,319			41	8
0605	37,412		42	0724				20	4
0606	34,025		39	0725				38	6
0607	44,444		40	0726	254,816			36	5
0608	100,354		30	0727	67,190			28	3
0609	75,161		30	0728	247,007			39	3
0610	86,405	(10)	30	0729	114,519			46	1
0611			42	0730	99,370			48	1
0612			47	0731				33	1
0613	154,337		44	0801				45	1
0614	75,094		35	0802	107,643	(75)		47	1
0615	60,000		29	0803	82,773			45	1
0616	35,761		30	0804	57,037			46	1
0617	36,364		32	0805	24,451				
0618			33	0806	103,960		31		
0619			34	0807					
0620	111,039		34	0808					
0621	44,203		36	0809	125,967				
0622	72,283		38	0810	10,124				
0623	101,648		38	0811	15,091				
0625	162,216		36	0812	20,158				
0625			34	0813	36,114				
0627			37	0814					
U628	349,046	(25)	36	0815					
0629	43,500		36	0816	67,973				
0630			36	0817	18,445				
0701	[illegible]		42	0818	10,570				
0702	46,686		44	0819	30,612				
0703	45,943		46	0820	59.773				
0704			46	0821				25	5
0705			46	0822					
0706			47	0823	125,352				
0707	[illegible]		47	0824	12,611				
0708	35,692		48	0825	18,542				
0709	40,000		52	0826	9,970				
0710			52	0827-0831	127,472	(90)			
U711			46	0901-1211	636,256				
0712	191,071		44						
				TOTAL	6,604,638				

met during the entire smolt migration period. However on the Snake River, flows were expected to exceed the recommended minimum levels, but it appeared doubtful that optimum flows could be achieved for the full specified period.

Grand Coulee

Grand Coulee was operated to the flood control draft levels but above the power draft level to reserve some water for fish flows at the start of the migration season. On 30 April, the CRFC requested releases be increased to provide 140,000 cfs at Priest Rapids beginning 3 May. Except for the last 5 days of April, flows at Priest Rapids were above optimum levels all through the migration season averaging 165,000 cfs in April; 190,000 cfs in May; 158,000 cfs in June; and 163,000 cfs in July. Inflow to Grand Coulee exceeded power requirements during most of the spring season which forced spill to keep Grand Coulee from filling too fast. The major reyulation for fish at Grand Coulee in 1982 was to to minimize downstream flows and spill for supersaturated gas abatement. Grand Coulee discharges were reduced on several weekends due to light power loads, high spill levels in the system, and fisheries agencies requests to reduce weekend discharges. This resulted in faster filling than was desirable for flood control but due to the high dissolved gas levels, it was considered worth the risk of discharging even more water later in the season if natural runoff increased.

Brownlee

Brownlee was drafted for flood control in December and reached its lowest elevation of the year, 2014 feet, on 12 February before flows in the Snake and Columbia Rivers started rising rapidly requiring the initiation of flood control operations throughout the basin. The reservoir filled to elevation 2074 feet by 23 February, then began drafting again for flood control; however, the draft rate was limited by the continued high flows in the Lower Columbia. Although no special releases specifically for fish flows were made from Brownlee, the high reservoir elevation and flood control drafting helped augment the flow in the Snake River during April and May.

Dworshak

Dworshak was operated from 1 October through 15 November 1981, in accordance with special operating limits annually imposed to provide suitable flow conditions during the prime steelhead fishing season on the Clearwater River. Dworshak was below the flood control rule curve on 15 November, therefore, through the rest of November and December, the project was drafted as needed for power and staying below the flood control curve.

The 1 January Water Supply Forecast indicated inflows to Dworshak of 104% of normal runoff. Therefore, the project outflow was increased to full powerhouse capacity on 6 January and was held at that rate until 16 February. Inflow to the project began increasing on February due to the heavy rains that hit the entire Pacific Northwest. Inflows increased from 5,800 cfs on 14 February to a peak of 39,800 cfs on 21 February.

The outflow was reduced to a minimum (1,000 cfs) from 18 to 24 February for flood control. Project releases beyan increasing on 25 February in an effort to recover flood control space. The project was spilling from 26 February through 5 April.

In response to the fishery agencies' request of 16 April for 120,000 cfs at Lower Granite, Dworshak outflows were increased to full powerhouse capacity on 16 April and held at that level through 26 April. When Lower Granite flows were above 120,000 cfs, Dworshak was then operated to hold the pool near flood control levels and meet power loads. On 12 May, Dworshak outflows were increased again to full powerhouse capacity, at the request of the CRFC, to augment Snake River flows. With the limited storaye available in Dworshak, these flows could only be maintained for 3 days, then the project was reduced to minimum release to follow the refill schedule.

Section IV

FISH PASSAGE

Smolt Migrations

Methods

Juvenile salmonid migrations were sampled at Lower Granite Dam on the Snake River and Priest Rapids, McNary, and John Day Dams on the Columbia River in 1981. Sampling schedules at the various locations were as follows:

Sampling site	Period sampled
Lower Granite Dam	3 April to 26 June
Priest Rapids Dam	1 to 31 May
McNary Dam	27 March to 11 September
John Day Dam	21 April to 11 December

Fish entering the fingerling collection system at Lower Granite and McNary dams were sampled. Numbers sampled were expanded by the sampling rate/hour to provide estimates of numbers collected at each of these dams. Turbine intake yatewells were sampled at Priest Rapids Dam. An air-lift pump system was used at John Day Dam to sample intake Units 3 B and 3 C.

A percentaye of smolts sampled at McNary Dam Was marked by freeze branding and released back into the reservoir above the dam. Recoveries of these marked fish (adjusted to reflect sample size and handling mortality), were used to calculate flow-efficiency regression lines (Figure 16.) The relationships shown are from 1982 data only, and should not be considered final. The regression equation for McNary Dam will be upgraded and precision increased as more data points are obtained in subsequent years, particularly in the area near or at 100% powerhouse flow. A similar regression was calculated for steelhead at Lower Granite using 1980, 1981 and 1982 data (Figure 17). (See Sims and Gioryi, in press, for details.)

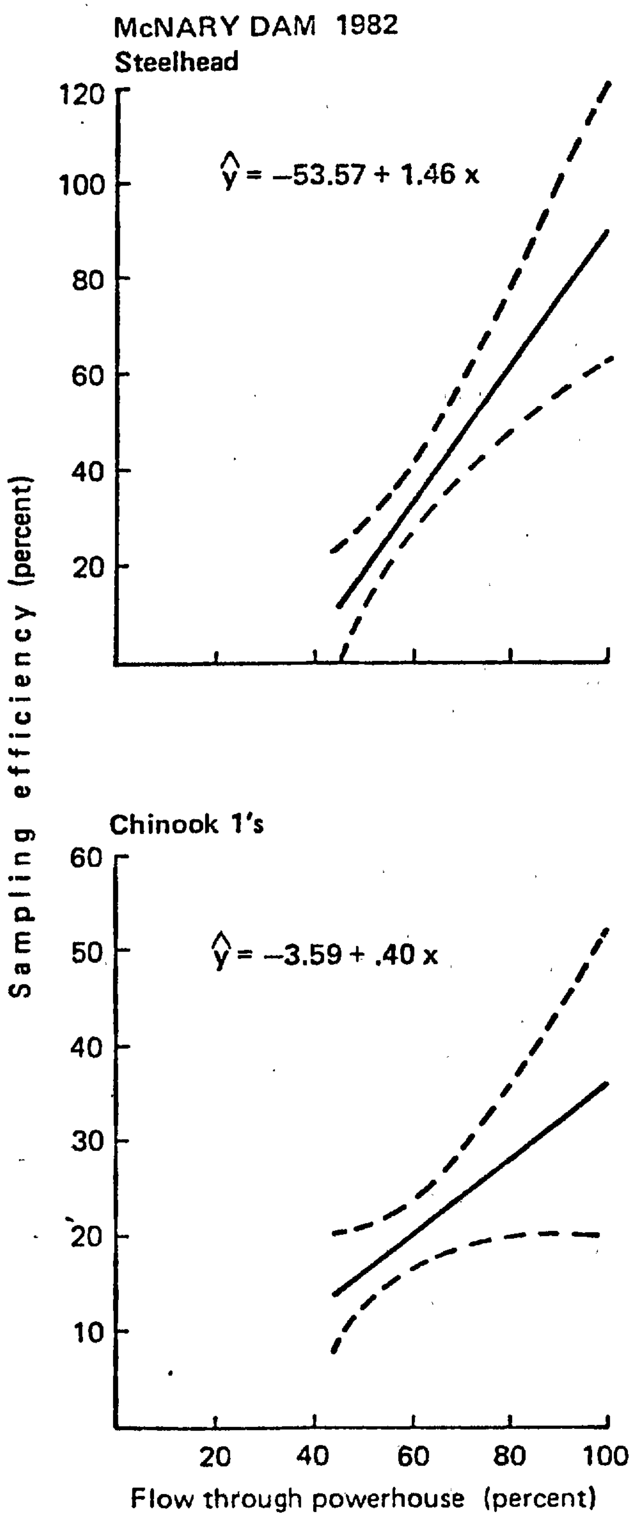


Figure 16.--Relationship of sampling efficiency to percent flow through the turbines at McNary Dam. Broken lines represent the 90% confidence limits. (Source: NMFS)

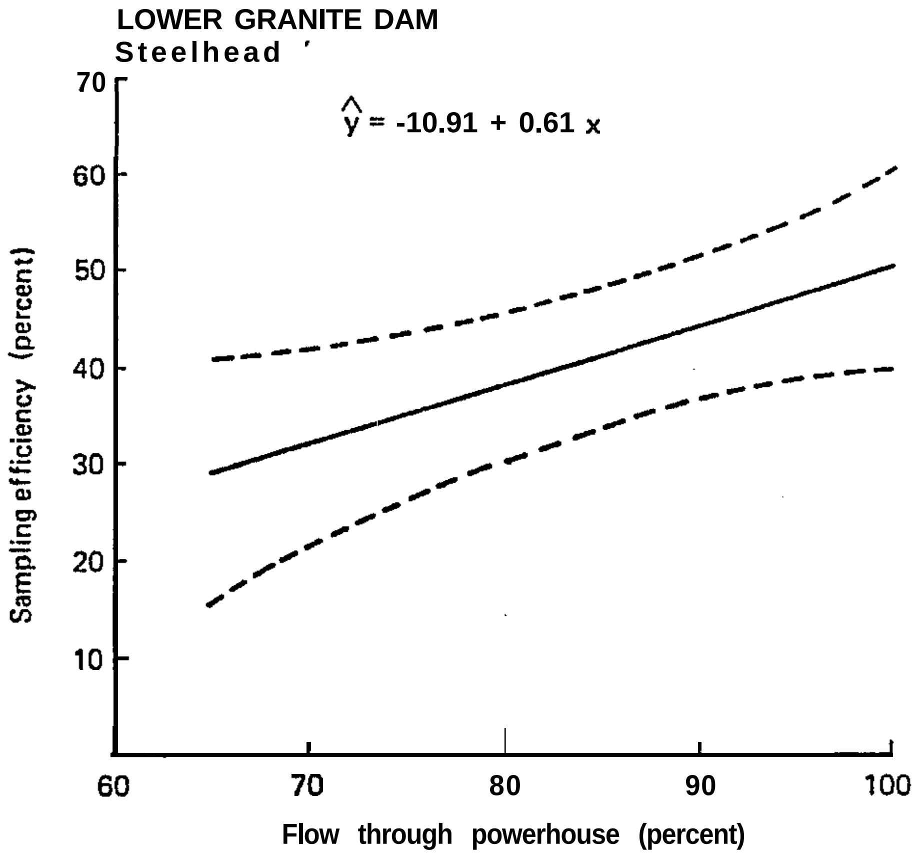


Figure 17.--Relationship of sampling efficiency to percent flow through the powerhouse for three years of steelhead data (1980-1982) at Lower Granite Dam. Broken lines represent 90% confidence limits. (Source: NMFS)

Not all mark-release and sampling situations lend themselves to regression analysis. If either the number of marked lots are few, or changes in powerhouse discharge are negligible over the sampling period (as was the case at Lower Granite Dam in 1981). another form of analysis must be applied.

The NMFS has devised a procedure whereby sampling efficiencies estimated under either of the aforementioned limiting conditions are adjusted to a standard flow through the sampling unit, be it a gatewell as in the case of John Day Dam, or a bypass collection facility such as that in place at Lower Granite Dam. A mean collection efficiency at the given flow and the 90% confidence limits for that mean are then calculated for those adjusted estimates.

Then, according to our model the mean and 90% confidence limits are projected to the origin based on the assumptions:

1) With no water entering the sampling unit, there can be no marked fish entrained in the unit, thus the estimated sampling efficiency is zero.
2) The variance is proportional to the flow through the sampling unit, resulting in the estimate boundaries approaching zero at the oriyin.

Figure 18 illustrates the application of this procedure to 4 years of chinook data collected at John Day Dam. This model was similarly applied to steelhead at John Day and one year of chinook data at Lower Granite Dam (Figures 18 and 19).

Although the upper and lower boundaries are not, and should not be construed as confidence limits, they do provide tolerance limits around the projected mean estimator line, which considering the small variability around the actual data points from which they were derived, appears consistent and reproducible for several years of data. Henceforth, we will refer to these as the 90% estimate boundaries.

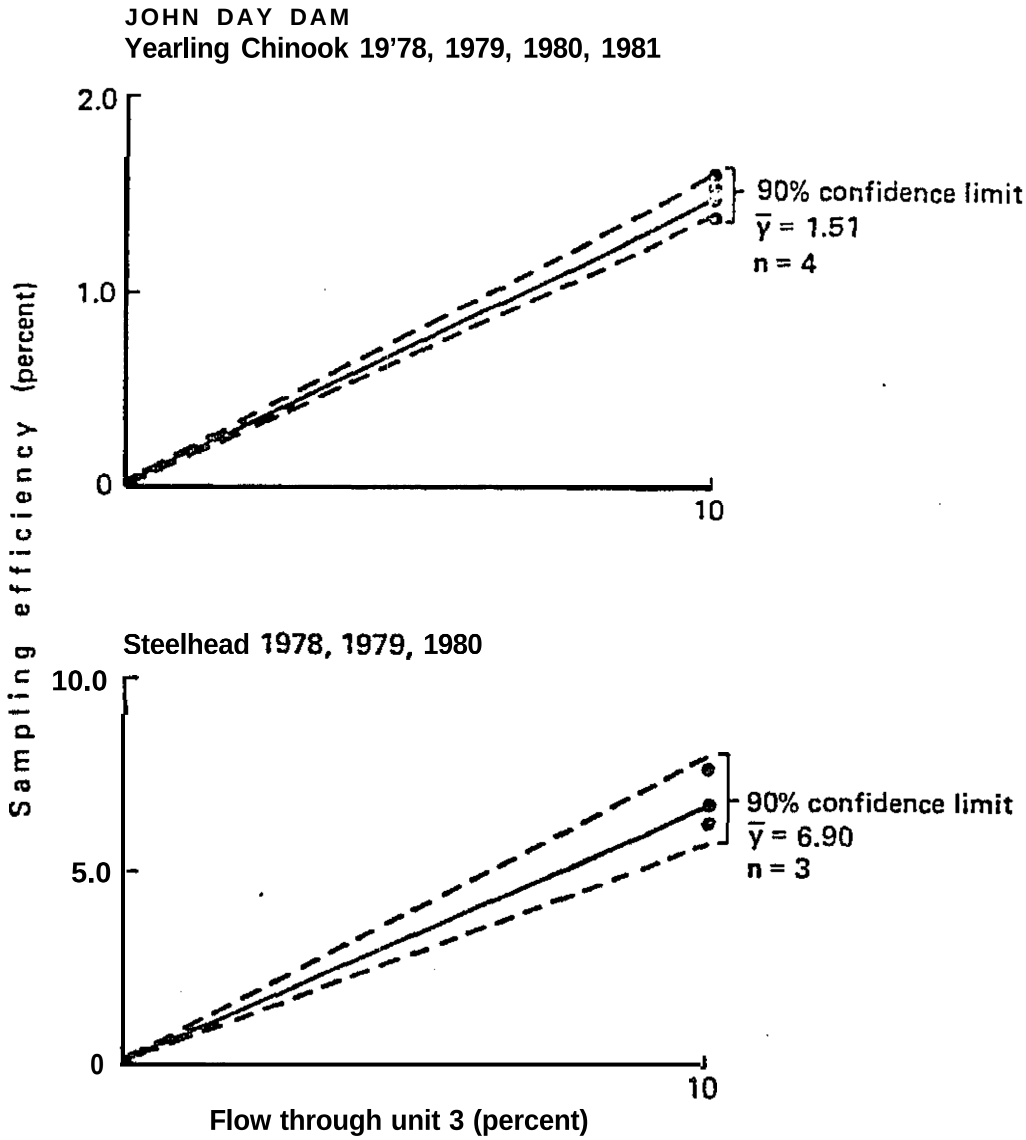


Figure 18--Relationship of sampling efficiency to the percent flow through turbine unit #3 at John Day Dam. Broken lines represent the 90% estimate boundaries, as described in text. (Source: NMFS)

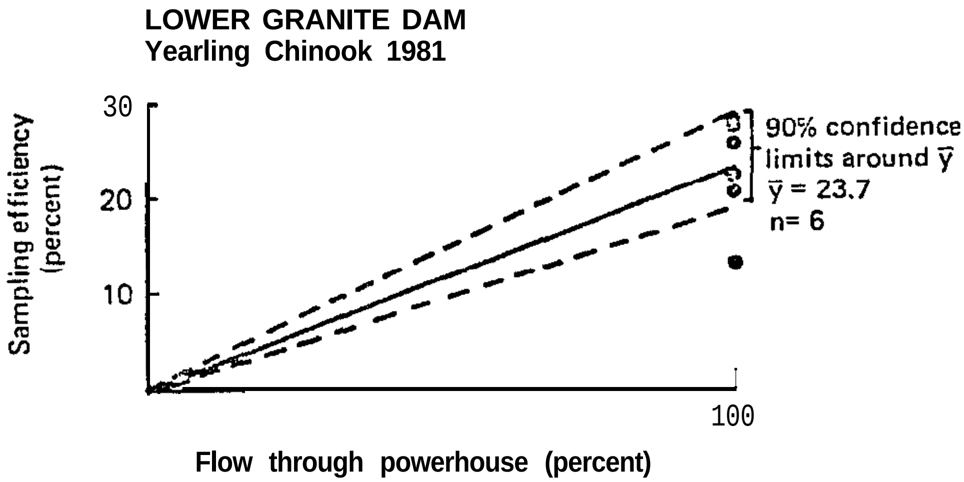


Figure 19.--Relationship sampling efficiency to percent flow through the powerhouse at Lower Granite. Broken lines represent the 90% estimate boundaries, as described in the text. (Source: NMFS)

Daily and annual population estimates with corresponding 90% confidence limits or 90% estimate boundaries are then calculated from the sampling efficiency relations.

If, in future years, the NMFS is permitted to mark spring chinook at Lower Granite Dam we will be able to apply regression analysis techniques and generate more precise population estimates. However, we see no need in executing more efficiency brand releases of steelhead or spring chinook at John Day Dam since Bonneville Dam is scheduled to replace it as the lower river index site in a few years.

Because of high spill, estimates of magnitude of migrations passing Priest Rapids Dam could not be made in 1982. Sampling of gatewells did provide a general estimate of timing, but the spill was so much higher in 1982 compared to previous years, that a measure based on catch per unit of effort in the powerhouse, as was done previously (see Table 8, 1981 COFO Annual Report), would not be meaningful. With the much higher spill most fish that passed through the spill and powerhouse indices are not indicative of total numbers passing the dam. Development of expansion equations, based on powerhouse sampling efficiency for various levels of spill, as at John Day Dam, would provide the needed measures of daily smolt passage and subsequent estimates of relative magnitude and survival of migrations passing Priest Rapids Dam.

Travel times through specified sections of the Columbia River system were calculated from recoveries of marked fish; the difference between the median 'release date and the median recovery date provided this information. Travel times calculated in this manner reflected the movement rate of only those fish surviving from point of release to point of recapture.

Measures of timing of smolt migrations passing each sampling site provide the data for justifying spill for protection of migrants at dams where there are inadequate fingerling bypasses. Methods used and results obtained in 1982 are contained in Section III (Project Operations and Monitoring of Smolt Migrations).

Survival was estimated by comparing the actual recovery rate of marked fish released from a hatchery or a dam with the expected recovery rate (100% survival) at that dam as estimated from measures of sampling efficiency. For example, if sampling efficiency at McNary Dam was 14%, and 7% of a marked fish group were recovered, then survival was 50% from the Point of release to McNary Dam, less any fish which may have been transported. See Raymond (1979)[2] for additional detail.

Confidence limits on survival estimates are based on sampling efficiency confidence intervals, or in those situations where we have not yet developed confidence intervals for our efficiency curves, confidence limits for survival estimates are defined by the variance around the mean recovery rate of mark release groups.

Brands on fish released from hatcheries for homing experiments and system mortality measures in the mid-Columbia provided additional data on timing and survival.

Travel Time

Based on marked recoveries, travel time of Snake River smolts from Lower Granite Dam to John Day Dam was measured at 14 days for chinook salmon, and 9 days for steelhead in 1982 (Table 8). Based on the travel time/flow curve developed over the past 9 years (Figure 20), and levels of Snake River flow in 1982, we would have expected travel times of 10 days for both chinook salmon and for steelhead. Why the discrepancy between measured and expected chinook travel time is unkown.

Similar travel time relationships have not been established in the mid-Columbia River because studies comparable to those undertaken on the Snake River have not yet taken place. Travel time measurements from releases of marked fish for the system mortality study do not appear realistic. Travel time of those fish released at Pateros (near Wells Dam) to Priest Rapids Dam was 19 days, an average of 6.6 miles per day, compared to 24 days (average 10 miles per day) between Pateros and John

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[2] Raymond, H.L. 1979. Effects of dams and impoundments on migration of juvenile chinook salmon and steelhead from the Snake River, 1966 to 1975. Trans. Am. Fish Soc., 108(6):505-529.

Table 8.--Travel time from Lower Granite Dam to John 'Day Dam for yearling chinook salmon and steelhead smolts, 1973-82.

Year	Average river flow at Ice Harbor Dam (cfs)[a]		Average river flow at John Day Dam (cfs)[a]		Average travel time (days)	
	Chinook	Steelhead	Chinook	Steelhead	Chinook	Steelhead
1973	71,000	68,000	150,000	146,000	22	20
1974	158,000	103,000	351,000	317,000	12	14
1975	140,000	136,000	344,000	344,000	12	10
1976	110,000	167,000	363,000	339,000	15	17
1977	40,000	40,000	125,000	119,000	36	37
1978	106,000	106,000	268,000	273,000	11	10
1979	85,000	89,000	255,000	255,000	13	13
1980	110,000	99,000	261,000	249,000	12	10
1981	94,000	89,000	291,000	226,000	12	15
1982	120,000	126,000	360,000	385,000	14	9

a/ at migration peak ± 7 days.

Source: NMFS

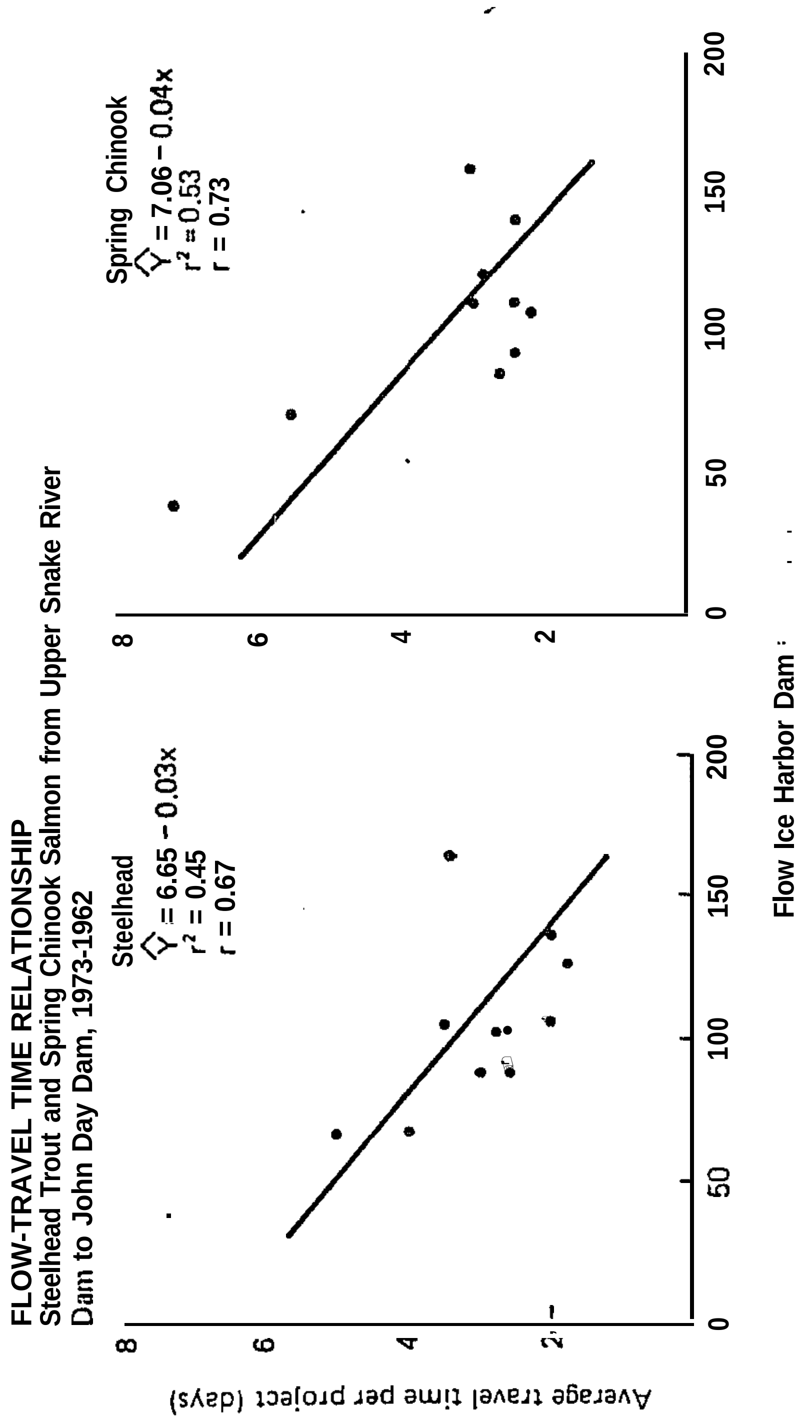

Figure 20.--Regression lines of the average travel time per project to total river flow (kcfs) measured at Ice Harbor Dam ± 7 days peak migration. (Source: NMFS)

Day Dam. By contrast, rate of migration measured between Lower Granite and John Day dams was 16 miles per day for chinook salmon, and 22 miles per day for steelhead. Flows were high in both reaches of the river and rate of movement should have been comparable. A logical explanation is that those fish marked for the system mortality study were not smolting at the time of their release. Once they started migration, their rate was comparable to those migrating from the Snake River.

Magnitude and Survival of Migrations

Point estimates were made for steelhead and spring chinook salmon populations at Lower Granite, McNary, and John Day Dams (confidence limits are in parentheses):

	Lower Granite (No. x 10^6)	McNary (No. x 10^6)	John Day (No. X 10^6)
Steelhead	4.33 (3.27-6.81)	1.45 (1.06-1.81)	1.21 (1.03-1.46)
Sp. chin.	2.09 (1.73-2.65)	3.78 (3.08-5.09)	1.76 (1.67-1.86)

Approximately 2.1 million chinook salmon and 4.3 million steelhead smolts were estimated to have arrived at Lower Granite Dam in 1982. This compares to 3.2 million chinook salmon and 3.7 million steelhead in 1981. Approximately 0.67 million chinook salmon (32%) and 2.37 million steelhead (52%) of the total smolt outmigration were collected at Lower Granite and Little Goose dams of which most were transported downstream. Spill averaging 27% through most of the migration resulted in lower percentage'of the migration being collected than *in* previous years. The lower collection of chinook was primarily due to lower guiding efficiency of the submersible traveling screens (see special tests for additional detail). Additional numbers of Snake River fish were collected at McNary Dam and transported, but it was not possible to make estimates because there was no means to differentiate between Snake and mid-Columbia stocks of fish at McNary Dam. Scheduled marking of fish at selected hatcheries starting in 1983 should provide the means to define magnitude and relative survival of the various stocks of fish transported and· those not transported to the lower river in subsequent years.

As previously indicated, estimates of magnitude of spring migrations of smolts at Priest Rapids Dam was not made because of high spill. However, estimated numbers of fish starting migrations were comparable to numbers in 1981 and with high spill survival should have been as high, or higher, than 1981. Therefore, it was assumed the magnitude of migrations from this area was comparable to the 5.5 million fish estimated in 1981 (see Table 8, 1981 COFO Annual Report).

Approximately 3.8 million yearling chinook salmon and 1.5 million steelhead were estimated at McNary Dam in 1982. No estimates of sockeye and coho salmon magnitude were made. Approximately 820,000 yearling chinook salmon (20%), 64,000 coho salmon, 175,000 sockeye salmon, and 440,000 steelhead (33%) of the estimated smolt migration at McNary Dam were collected and transported below Bonneville Dam. Spill, averaging 41% significantly reduced collections of migrants (see Juvenile Collection and Transport for additional detail).

The estimate of 1.76 million yearling chinook salmon at John Day Dam equates to a 59% survival of yearling chinook salmon between McNary and John Day dams. This was much lower than expected because potential to John Day Dam with 100% survival was 3.0 million fish (3.8 million minus 0.8 million transported from McNary Dam). The point estimate for survival of yearling chinook salmon from McNary Dam to John Day Dam based on selected marks was 68% (90% confidence limits = 37-99%) corroborating the 59% survival estimate based on estimated magnitude.

In contrast. steelhead survival from McNary to John Day dams based on selected marks, was estimated at 91% (90% confidence limits = 61-121%). It was not possible to calculate comparative survival estimates from population sizes due to the infusion of an unkown quantity of steelhead fra both the Umatilla and John Day rivers. However, one can see that it was near 100% (1.45 million steelhead minus 0.4 million transported from McNary and 1.2 million steelhead estimated at John Day Dam). The much higher steelhead survival is more in line with that expected with the higher flows and spill provided in 1982.

Apparently, poor fish quality rather than poor passage has been more a factor affecting survival of yearling chinook salmon from the mid-Columbia in recent years. A similar decline of these fish occurred in 1981 when there was a higher than normal incidence of kidney disease in spring chinook salmon released from hatcheries (G. Taylor, FWS Leavenworth Hatchery, personal communication). If we assume the same magnitude of migrations above McNary Dam in 1982 (approximately 5 million fish minus 0.8 million transported = 4.3 million potential to John Day Dam), then the overall loss in 1982 from areas above McNary Dam to John Day Dam would have been comparable to the 41% measured in 1981, 1.77 million at John Day Dam/4.3 million = 41%. The difference in the two years is area of loss. In 1981 from timing and low collections at McNary Dam, it appeared that much of the loss occurred above McNary Dam (see 1981 COFO Annual Report). In 1982, with 3.8 million fish estimated at McNary out of 4.3 million plus from areas above McNary and only 1.77 million fish at John Day Dam, it appears that most of the loss occurred below McNary Dam.

Various estimates of survival of steelhead and yearling chinook salmon from the Snake and mid-Columbia rivers also show that survival of steelhead was much higher than yearling chinook salmon in 1982.

Survival of steelhead from below Little Goose Dam (based on marked fish releases) to John Day Dam was estimated at 85% (90% confidence limit = 68-102%). This equates to a 95% per project survival. By contrast survival from above Lower Granite Dam to below Little Goose Dam (based on marked fish releases) was estimated to be only 54%, or a 75% per project survival. Since there was no sampling for marks at Little Goose Dam, there was no way to estimate numbers of marks transported from Little Goose Dam and therefore, no confidence limits could be placed on this point estimate (see Sims and Giorgi, 1983 for details). Estimates of survival from releases of steelhead from hatcheries also indicates a high mortality at Lower Granite and Little Goose dams. For example, steelhead released from the Tucannon Hatchery in the Tucannon River below Little Goose had over twice the survival of those released from the same hatchery in the Grande Ronde River. As above, though, no confidence limits can be placed on these estimates. Samples of steelhead obtained by the FTOT exhibited a higher descaling at Little Goose Dam than at Lower Granite Dam. The cause of the descaling may have been spill and large amounts of debris (see section on Transport Operations for further discussion). These conditions also may have affected survival. Overall, survival from above Lower Granite Dam to John Day Dam was (.54)(.85) = 46% (85% survival per project) the highest since the completion of the new dams in the late 1960s and 1970s (Figure 21).

Survival estimates for steelhead migrating through the mid-Columbia dams was obtained from releases of steelhead in the Methow River above Wells Dam and releases below Priest Rapids Dam. Both groups were from the same hatchery. From recovery of those marked at McNary Dam, survival through the five PUD dams was estimated at 57% (90% confidence limits = 42-71%) an 89% average survival per project; slightly higher than the 85% per project survival on the Snake River.

In contrast with the same protection provided by spill and optimum river flows, survival of nontransported yearling chinook salmon from Lower Granite Dam to John Day Dam was estimated to be only 25% (75% average survival per project). There are no confidence limits about this point estimate. This figure was based on the average survival of a number of marked hatchery groups between Lower Granite Dam and John Day Dam, since no marking of yearling chinook salmon was permitted at Lower Granite Dam in 1982.

Preliminary survival estimates for yearling chinook salmon from the mid-Columbia system mortality experiments indicated an overall survival of 45% ± 5% (86% average survival per project) for passage of smolts through the five PUD dams and 38% overall survival to McNary Dams. Per project survival through Wells, Rocky Reach, and Rock Island dams was 87%

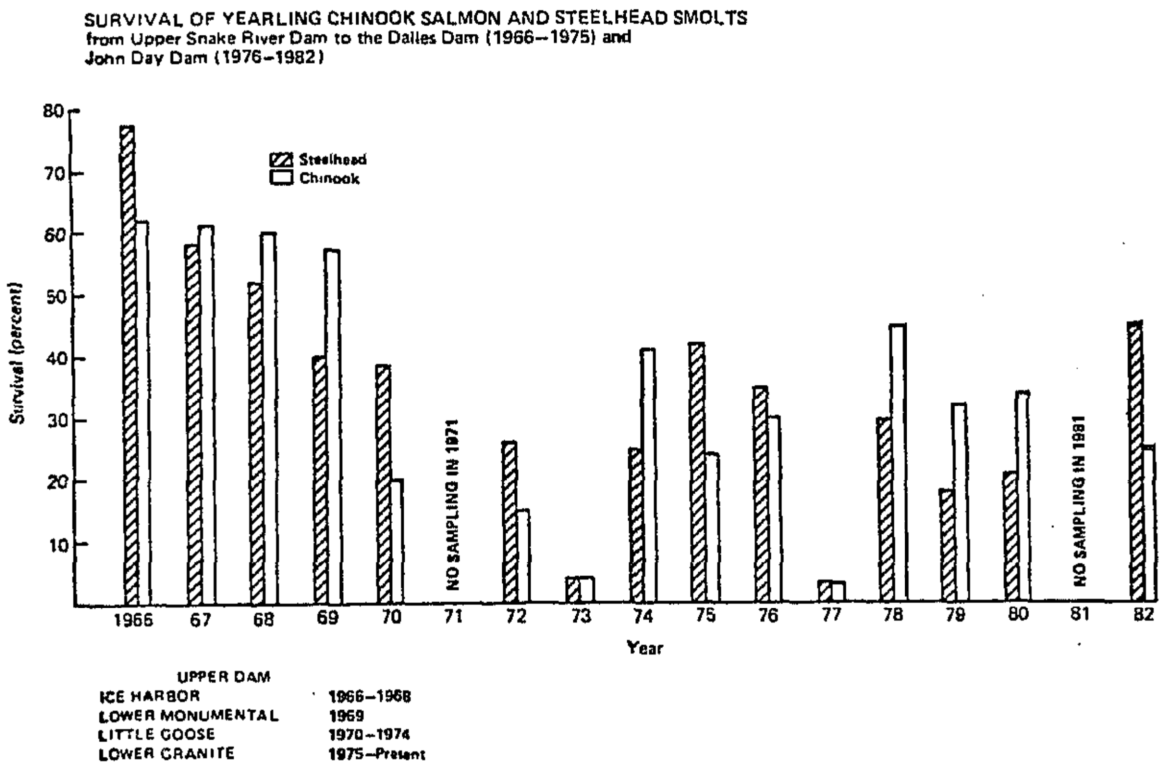

Figure 21.--Survival of yearling chinook salmon and steelhead smolts from 1966 to 1982. (Source: NMFS)

compared to 83% through Wanapum and Priest Rapids dams, and 83 between Hanford and McNary Dam. (See McKenzie et al 1983 for additional detail.)

These fish along with other marked fish releases had a 68% survival (90% confidence limit = 37-99%) from McNary Dam to John Day Dam, for an overall survival of 26% from above Wells Dam to John Day Dam (.38 x 68). This compares quite closely with the 23% survival estimate for Snake River fish from above Lower Granite to John Day Dam. The decreasing per project survival as the migration of the system mortality fish progressed downriver also suggests that other than passage related mortalities (as discussed previously) are affecting survival of mid-Columbia yearling chinook salmon.

Juvenile Collection and Transport

Collection and mass transportation of juvenile salmonids occurred at Lower Granite and Little Goose dams located on the Snake River and at McNary Dam located on the Columbia River. Dates of operation were from 30 March to 24 September. The 1982 transport season was a successful management operation, with the COE providing manpower and support and the fishery agencies providing biological oversight. Daily project operations were handled by COE biologists and state fishery biologists/culturists. The Fish Transportation Oversight Team (FTOT) provided oversiyht for the program and coordination between fishery agencies, tribal representatives, and COE.

Spring chinook smolts have not benefited from transportation to the extent that steelhead have. For that reason, the Columbia River Fisheries Council (CRFC) decided to not maximize transportation from the Snake River projects. This operation commenced 17 April and ended 17 May, a timeframe when maximum numbers of spring chinook and steelhead were emigrating from the Snake system. During this period, the CRFC requested that Lower Granite and Little Goose limit power generation to 80,000 cfs when total river flow was under 120,000 cfs. Power generation could be increased when total river flow exceeded 120,000 cfs provided there was a voluntary spill of 40,000 cfs.

Five fish hauling trucks were available during the fish run. Rated capacity is 3,500 gallons of water per vehicle, and at the present hauling criteria of 0.5 lb of fish per gallon of water, a loaded truck would haul approximately 1,750 lbs of fish. Driving time varied with the distance traveled. An average trip to Bonneville from Lower Granite took approximately 8 hours, Little Goose 6-1/2 hours, and McNary 3-1/2 hours. A fourth fish barge was completed prior to the fish migration season. Fish barges 1 and 2 have a capacity of 85,000 gallons of water, and a water flow of 5,200 gpm. Barges 3 and 4 have capacities of 100,000 gallons of water and a flow of 5,200 and 10,000 gpm, respectively. Fish barges were used extensively from 20 April through 10 June with the exception of two days due to a tug accident. The tug sank when it attempted to negotiate a 55-knot windstorm below McNary Dam on 26 May.

Two of the crew members were killed in the accident. All smolts were released unharmed into the John Day Pool. COE is presently conducting a review of the accident, and recommendations will be forthcoming on tug requirements, safety precautions, and operating procedures.

All 3 projects were equipped with wet separators patterned after the Little Goose model. A wet separator is designed to keep fish in water at all times. The new separator allows floating material to be separated from fish. Bar spacings of 1-1/2 inches at Snake River projects and 1-1/4 inches at McNary separates most rough fish and adult salmonids from juvenile salmonids. It was decided by the CRFC prior to the season that there would be no separation of smolts by size or species.

Changes were made at Lower Granite and McNary to pass fish through a single 6 X 12-inch orifice to a distribution flume. Samples of fish at Lower Granite and McNary were electronically counted as they exited the sample tank. Total fish numbers were estimated by expanding the hourly sample. At Little Goose, all fish were counted via six 4-inch electronic counting tunnels which exited into a distribution system as in 1981.

A random sample of fish was diverted hourly through electronic counting systems and into holding areas where they were examined daily or as needed: species enumeration, descaling, mortality, weiyht sample, and mark recapture information. Fish to be marked for research purposes were also taken from this sample.

A fish was considered descaled when at least 10% of its scales were missing. Whenever possible, daily samples of 100 fish were checked for descaling. Data from seawater challenge tests, delayed mortality holding tests, and daily observation of mortalities taken from the raceways and barges has shown that mortalities were much higher on descaled fish.

Submersible traveling screens (STS) were placed into service prior to the beginning of the spring migration. STSs are an intergral part of the collection system. Tests were conducted at Lower Granite and McNary in 1982 to determine fish guiding efficiencies of STS's, and to determine feasibility of screen cycling. (See special studies for results of these tests).

STSs were inspected periodically by video camera at each project. Daily inspections of ampere meters were conducted by project and state biologists. Problems were corrected as needed. With the exception of 5 STSs at McNary Dam, the screens operated satisfactorily this year with no significant time loss of turbine operations caused by screen problems. Post season inspections revealed only minor damage to screen mesh and some wear on sprockets and chain drives.

High spill conditions and CRFC's decision not to maximize transportation resulted in lower than anticipated collection and transportation rates this year. Total collection from all projects was 6,357,216 (Table 9 through 12). Estimates of collection were based on electronic counting: sample hand counts were routinely compared with electronic counts. During 1982 discrepancies between the two ranged between 5% and 18% at Lower Granite Dam, and totals shown were 96.5% of actual at Little Goose Dam and 99.7% of actual at McNary Dam. Numbers shown have not been adjusted for the errors noted.

Lower Granite Dam--The fingerling collection system began operating on 4 April when the collection system and new wet separator were watered up and continued on a 24-hour/day regime through 29 July. All turbine intakes were screened. Project personnel began lowering STSs into position on 30 March and completed installiny all 18 screens by 2 April. The first juveniles were transported on 8 April, and the final load departed on 29 July. Major modifications and system changes for the 1982 transport season are listed below:

1. New nylon mesh with a l-inch plastic strip along the margin was installed on all STSs. Metal guard plates were placed along the sides of the frame to prevent juveniles from entering the gap between the edge of the screen mesh and the chain.
2. A new video monitoring system was purchased by COE for use at Snake River collector projects.
3. A new wet separator was constructed and installed.

Table 9.--1982 Juvenile fish transport summary and dates of operation.

	Trucked	Barged	Total
Lower Granite			
4 April-29 July			
Spring chinook	63,965	292,987	356,952
Fall chinook	98,622	11,793	110,415
Steelhead	235,353	1,137,959	1,373,312
Sockeye	5,642	5,082	10,724
Coho	85	120	213
Total	403,667	1,447,949	1,851,616
Little Goose			
8 April-21 July			
Spring chinook	8,433	215,992	224,425
Fall chinook	105,288	2,567	107,864
Steelhead	81,635	815,825	897,460
Sockeye	2,294	1,852	4,146
Coho	201	14	215
Total	197,851	1,036,259	1,234,110
McNary			
31 March-24 September			
Spring chinook	61,552	728,366	789,918
Fall chinook	1,454,799	145,909	1,600,708
Steelhead	14,843	338,649	353,492
Sockeye	18,650	168,729	187,379
Coho	1,539	70,817	72,356
Total	1,551,383	1,452,420	3,003,853

Trucked total	2,152,901
Barged total	3,963,678
Transport total	6,089,579

Table 10.--Transport summary by dam of juvenile fish collected from 1978 through 1982.

	Lower Granite	Little Goose	McNary	Total
1978	1,980,600	996,285	82,211	3,059,906
1979	2,367,446	1,453,615	1,247,120	5,068,181
1980	3,830,747	2,282,987	1,740,545	7,854,279
1981	2,730,866	1,464,991	4,112,993	8,308,850
1982	1,851,616	1,234,110	3,003,853	6,089,579

Table 11.--Transport summary of total juvenile fish trucked or barged from the collector facilities at Lower Granite, Little Goose, and McNary Dams from 1978 through 1982.

	Trucked	Barged	Total
1978	1,580,724	1,478,372	3,059,096
1979	2,031,212	3,036,969	5,068,181
1980	3,019,232	4,835,047	7,854,279
1981	3,145,980	5,162,860	8,308,850
1982	2,152,901	3,936,678	6,089,579

Table 12.--Number of chinook salmon and steelhead smolts arriving at the upper dams on the Snake River and the number and percent of the total Snake River outmigration transported below Bonneville Dam 1971-1982 (includes experimental fish marked for transport evaluation).

	Chinook smolts			Steelhead smolts		
	No. at upper dam (1,000)	No. hauled (1,000)	Percent hauled	No. at upper dam (1,000)	No. hauled (1,000)	Percent hauled
Transport from Little Goose Dam						
1971[a]	4,000	109	3	5,550	154	3
1972	5,000	360	7	2,500	227	9
1973	5,000	247	55	5,500	176	3
1974	3,500	0	0	5,000	0	0
Transport from Lower Granite and Little Goose Dams combined						
1975	4,000	414	10	3,200	549	17
1976	5,000	751	15	3,200	435	14
1977	2,000	1,365	68	1,400	895	64
1978	3,180	1,623	51	2,120	1,355	64
1979	4,270	2,109	49	2,500	1,712	67
1980[b]	5,600	3,254	58	3,600	2,860	79
1981[b]	3,200	1,549	46	3,700	2,737	74
1982[c]	2,100	581	28	4,600	2,271	49

[a] Data for years 1971-79 from Smith et al. (1980).
[b] Number of smolts estimated at upper dam from Sims et al. (1981/82).
[c] Number of smolts estimated at upper dam (see Sims and Giorgi, 1982, for totals and 90% C.L. about estimates).

4. A new distribution system was constructed to improve transfer of fish from the wet separator to the raceways.
5. A new sample tank was installed with electronic counting tunnels that operated on a sample mode. From 2 to 6% of the total fish were sampled daily.
6. A new sample holding tank was installed to free one of the raceways from use as a sample/holding area.
7. Loading lines were replumbed, and increased from b-inch diameter to 10-inch diameter.
8. A direct loading line from the wet separator to the barge dock was constructed, but not completed in time for use in 1982.
9. New raceway crowding screens were constructed to allow trash and fish to be separated prior to loading operations.

The annual Snake River runoff was the sixth highest recorded. Near record snow packs in many regions contributed to the flows. The month of May was cooler and drier than normal, and peak runoff was somewhat delayed. Snake River flows peaked on 18 June (206,000 cfs) at Lower Granite. Because of high snowpack and later than normal runoff, water temperatures remained low during the spring migration. Forebay temperature had only reached 58°F by 30 June, and 68°F by 29 July when the system was shut down. Turbidity during the spring migration ranged from 0.9 to 4.6 feet (Secchi Disc Readings).

Migrating juveniles moved readily downstream during 1982. Marking at hatcheries showed that: (1) steelhead from Dworshak National Fish Hatchery were observed at Lower Granite in less than 4 days following release, and (2) groups of steelhead and chinook salmon from the remainder of the Snake River hatcheries migrated in an orderly and timely fashion.

Peaks in the juvenile outmigration were not as pronounced as those seen in the previous two years. However, the period when 80% of the smolts miyrated past Lower Granite was similar to the dates observed during the preceding three years.

Approximately 1.94 million juveniles were counted into the collection facility at Lower Granite in 1982. Of these, 1.85 million were transported (1.45 million by barge and 0.4 million by truck) to release sites below Bonneville Dam. Numbers transported by species included: 0.36 million yearling chinook salmon, 0.11 million subyearling chinook salmon and 1.47 million steelhead. Estimated percent of the total estimated juvenile outmigration transported, based on NMFS estimates of populations (see Table 11), was 17% for yearling chinook salmon(90% confidence limits = 13-21%), 21% for fall chinook salmon (no confidence limits calculated), and 38% for steelhead (90% confidence limits = 19-43%).

The high flows of the 1982 runoff in the Snake River drainage carried downstream a massive amount of floating debris. This condition was compounded even more since the previous two seasons were low flow years, and much of the debris from the upper watersheds was washed downstream during the 1982 runoff. The project forebay was not cleared of debris prior to the transport season since a late winter flood in February was responsible for a considerable accumulation of logs and other floating debris. Project workers began raking trash racks on 8 March and had completed raking all units on 10 March. However, project personnel were unable to clear the forebays. Large amounts of debris continued to accumulate at Lower Granite in late April and May. Trash racks were raked periodically throughout the 1982 transport season.

Dates and turbine unit intakes raked for trash accumulation during the 1982 transport seaosn at Lower Granite Dam are as follows:

Date	Intake racks raked	Date	Intake racks raked
3-08	1-A,B,C 2-A,B,C	6-16	1-A,B,C
3-09	3-A,B,C 2-C	6-18	2,3,4,5,6-A,B,C
3-10	4,5,6-A,B,C	6-18	2,3,4,5,6-A,B,C
4-06	4-A,B,C 5-A,B,C 6-A,B	7-14	1-A,B,C 2-A,B,C
4-07	3-A,B,C 2-A,B,C 1-C	7-15	3-A
5-12	1-A,B,C 2-A,B,C 3-A	7-26	3-A,B,C
5-13	3-B,C 4,5,6-A,B,C		
5-28	1-A,B,C 2-A,B,C		

Researchers testing STS cycling found salmonids trapped and killed inside the STS. Further testing revealed, though, that the problem was not as severe as the workers initially believed. The evidence later indicated that most of the juveniles entered the screen mesh when STSs were being raised or lowered for research purposes. There was no evidence of this problem with screens that had remained in operation throughout the migration.

Juveniles collected in the daily samples were examined for descaling between 13 April and 29 July. Descaling fluctuated during the 1982 season, and was highest for both species in late April and early May. Descaling rates were recorded for both chinook and steelhead, and averaged 8.2% and 8.6%, respectively. (During the previous year, rates were much higher and averaged 13.4% and 16.8% for chinook and steelhead, Basham et al. 1982). During 1982, average weekly 'chinook descaling ranged from 2.0 to 20.8% while steelhead ranged fro 1.6 to 19.8%.

Beginning in early May, workers separated descaling rates for wild and hatchery steelhead. As expected, descaling was much lower for juveniles of wild oriyin in the sample. Wild steelhead averaged 2.3% between 2 May and 18 July and hatchery juveniles averaged 7.4%. Hatchery and wild steelhead were differentiated by external characteristics, (e.g., deformed or nondeformed fin rays).

Workers observed that daily fluctuations in descaling rate were often associated with trash removal work in the forebay and with periodic mechanical problems with the collection system. However, it now appears that the arrival condition of various hatchery stocks causes the greatest descaling fluctuations at Lower Granite.

<u>Little Goose Dam</u>--Collection of fish for transport began on 8 April and ended on 21 July. Some 1.26 million fish were collected, of which 0.23 million were yearling chinook salmon, 0.12 million were subyearling chinook salmon and 0.91 million were steelhead. This year's total was 85% of the 1981 collection total because of increased spill and a lower outmigration of yearling chinook salmon in 1982. Of those collected, 1.0

million were transported by barge and 0.21 million by truck to the lower river.

A new collection hopper, 26.5 feet deeper including a smoother transition area, was designed and installed to eliminate air entrapment in the collection pipe and decrease upwell surging. Another purpose for the deeper hopper was to reduce negative pressures in the transition area of the pipe. On 1 April, a group of fish (1,000) from Dworshak National Fish Hatchery were placed into the fish hopper and run through the system. It was concluded that the bypass hopper was not causing immediate mortality or injury, such as descaliny or abrasions caused by the hopper or transport pipe.

The upwell structure was not able to accommodate the volume of water provided by the new hopper, therefore, it could not be operated at a proper water level to take full advantage of the new design. When the hopper was operated at low levels, foam collected on the separator and its water levels were hard to control. The system ran better when the water level in the hopper was kept high (within 3 ft of the water level exitiny from the powerhouse collection channel), but surging in the upwell was still a problem.

Modifications made to the wet separator included 1) air-operated trash dump gates placed in front of each counting tunnel entrance, 2) increased separator bar spacing from 1.25 to 1.5 inches, 3) removal of a central partition within the separator hopper, and 4) a water bypass line added to the upwell structure to allow total separator dewatering without dewatering the raceway headbox.

Some problems were experienced with the trash dump gates; fish were lost when the gates were jammed open and the separator was momentarily dewatered. The gates had to be closed using a long, heavy pole. Fish passing through the dump gates were either returned to the river or became temporarily trapped bettween the raceway head box wall and the upper raceway screen.

Raceway plumbing modifications were also made. These include gate valves being added at the head of each raceway for better control of water inflows. All 6-inch barge and truck loading pipes were replaced with lo-inch pipes and equipped with air-operated slide gates. The lo-inch lines operated much better than last year's 6-inch lines, and this modification seems to be the most beneficial change made to this year's system. There were no problems with lines plugging with debris as there was in 1981, and the amount of time necessary to unload a raceway was reduced for 45 to 60 min to about 10 min.

As in previous years large quantities of trash in the forebay caused considerable problems. Efforts to remove the debris were hindered by lack of equipment and personnel. The five main areas affected were: 1) plugging of the perforated plate directly upstream of the separator; 2) plugying of counting tunnels; 3) counting debris and fish; 4) accumulation of debris in raceways, and 5) plugging of the release hose during truck unloading below Bonneville Dam.

Descaling percentages at Little Goose were much higher this year than in previous years. For chinook salmon it was 26% vs 13.5% in 1981 and for steelhead 21.6% vs 11.3% in 1.981. Exact causes of high descaling rates could not be determined; however, possible contributing factors were: 1) passage of fish through turbines or over spillways at Lower Granite Dam, 2) design of the Little Goose Dam fish facilities, 3) quality of hatchery reared fish entering the system, 4) interaction of fish with debris as they passed through the collection facility, and 5) a change of personnel doing the'descaling evaluation between 1981 and 1982.

To determine whether fish were descaled at Little Goose Dam prior to arrival at that dam, descaling rates of fish sampled from gatewells were compared to those from the daily collections. These samples did not indicate a serious descaliny problem at Little Goose Dam. Since descaling at Lower Granite Dam was low (indicating that the descaliny was not occurring above that point), it would appear that the major cause of the descaliny can be related to passage at Lower Granite Dam. Since rate of descaliny at Little Goose Dam was lower in 1981 when magnitude of spill and debris was much lower at Lower Granite Dam, the data suggests that major causes of the high descaling in 1982 could have been spill at Lower Granite Dam and/or the large amounts of debris in the forebay.

McNary Dam--The fingerling collection system began operating on 30 March and continued through 24 September. STSs were placed into position in late February and March. Mechanical problems prevented five STSs from being placed into service at the start-up date. All screens were in service by 17 June.

Major system modifications which changed operational procedures during the transport season were:

1. New nylon mesh was installed on three screens with a l-inch plastic strip along the margin. Metal guard plates placed along the sides of the frame to prevent juveniles from entering the gap between the edge of the screen mesh and the chain drive.
2. A new video monitoring system was purchased for McNary project.
3. The trash rake was modified to facilitate cleaning.
4. A new wet separator was installed.
5. A sample tank with electronic counting tunnels was operated on a sample-only mode.
6. A sample holding tank was constructed to allow maximum use of raceways.
7. The truck loading system was modified to a flume type design.
8. Inspection caps and tees were placed in the barge loading lines to allow pipe inspection and cleanout.
9. The raceway water supply was modified to be independent of wet separator operation.
10. A rotary drum screen was placed in the juvenile bypass channel for testing.
11. A crane and boom were added to the loading system to improve barge loading.
12. A hand crowder was designed to facilitate loading from the temporary raceways.

An early unscheduled release of yearling fall chinook from Ringold Hatchery (18 March) pushed the facility starting date to 30 March. Fish were present from that release when juvenile collection was initiated. An earlier start-up date was not possible, as necessary work was being performed on the finyerling bypass channel, wet separator, and sampling system. Heavy spill at the project prior to 1 April probably passed a large percentage of the Ringold release.

Juvenile salmonids were collected at McNary from 30 March through 24 September. The facility collected 3.2 million salmonids during the transport season. Of these, 0.8 million (26.1%) were yearling chinook salmon, 0.7 million were subyearling chinook salmon, 0.07 were coho salmon, 0.36 million were steelhead, and 0.2 million were sockeye salmon.

This year was the longest collection and transport season to date, 177 days. The total fish collected in 1982 was 1.1 million less than the 1981 total of 4.2 million fish. Only steelhead collection in 1982 was similar to 1981. Other species varied from 20 to 47% less than 1981 collection totals. Reduced collection this year at McNary was primarily a rusult of increased river flow and heavy spills throughout the migration season. Peak collection days in 1982 by species were: yearling chinook salmon, 56,987 on 5 May; subyearling fall chinook salmon, 84,736 on 21 July; steelhead, 30,118 on 13 May; sockeye salmon, 12,026 on 5 May; and coho salmon 8,163 on 19 May.

Juvenile salmonids were transported throughout the migration season by fish barges or trucks. As in previous seasons, the trucking mode accounted for greater than 50% of the total transported. Trucks hauled 1.6 million (52%) and barges 1.5 million (48%) of the total fish transported (3,003,853). The percentages of fish transported by barges were: yearling chinook salmon, 92%; subyearling chinook salmon, 9%; steelhead, 96% sockeye salmon 90%; and coho salmon, 98%. At least 90% of the spring migrants were barged between 21 April and 10 June.

Trash racks at McNary were not adequately cleared of debris during pre-season cleaning because the trash knife broke in Slot 6B on 1 April.

This mishap left Slots 1B, 1C, 5A, 14A, 14B, and 14C uncleaned. The trash knife was recovered on 1 May and the A and B slots for Units 4-10 were cleaned on 9 and 11 June. Units 1-6 were cleaned on 30 July and 1 August. The trash knife cleans the upper portion of the racks by compacting trash to the bottom of the units. The greatest buildup of trash on the lower portion of the racks is in Units 1 and 2. Only two trash racks (1B and 6A) exceeded gatewell drawdown criterion this year. These were cleaned on 30 July and stayed in criteria the remainder of the season.

Prior to the juvenile outmigration, trash was removed from the forebay and gatewells. The bypass system was inspected daily to keep debris from buildiny up on bypass flume screens. Forebay trash was dipped by a crane and clamshell in mid June. The operation caused a heavy debris load in the system to the point that the bypass flume screens required cleaning every 2 hours. Project personnel reported a decline in fish quality and an increase in mortality duriny this operation and the project terminated trash dipping.

McNary is equipped with 42 STSs placed in bulkhead slots of the 14 turbine units. Twenty-six of the screens were placed in service early, between 24 February and 2 March, because the project had work scheduling conflicts with the lock outage in late March. Eleven additional screens were installed on 30 and 31 March. The remaining five screens were repaired and placed in service on the following dates: 20 April, 21 May, and 17 June. Screen outages are listed for the 1982 season as follows:

Screen Outages for 1982 at McNary Dam

Date	Slot #	Status
1-20 Aoril	1B	Bad gearbox
1 April-21 May	1C	Bad gearbox
1-12 April	5A	Net frame attachment for NMFS test
5 April-6 May	5A	Intermittent operation for NMFS test
30 April-2 May	6B	Intermittent operation for NMFS test
1 April-17 June	14A,B,C	Mesh repair
25 June-l July	5A	Tagged off by MNFS test
20,21 July	5A	Tagged off by NMFS test
13-20 July	14A.B.C	Unit repair
14 Aug-24 Sep	7A;B;C	Unit overhaul

Total screen outage time between 1 April and 24 September was 491 operatiny days, accounting for 6.6% of available screening time at McNary. Screen failures occurred in slots 2B, 5A, and 9A and the bad screens were promptly replaced with screens from Unit 7 which was down for unit overhaul.

Video inspections of STSs were conducted twice during the season. STSs were inspected on 14 May: (8B and 9A), and 9 and 11 June (A and B screens in Units 4 through 10). No inoperable screens were found, nor were there any tears observed in screen mesh. However, frequency and extent of TV inspections were inadequate. If there had been damage to STS mesh, it may not have been discovered and repaired in a timely fashion.

A post season inspection of the project on 17 November showed the screen mesh to be in good shape after two years of operation. Considerable sprocket and chain wear was evident. A teflon-coated plastic sprocket being tested by COE was in excellent shape after one year of operation.

Gatewell orifice blockages were a problem this season with a total of 14 blockages occurring. One cause of increased orifice blockages was increased amounts of debris in the river. Since an orifice must be substantially pluyged before it is visibly noticeable, a program of orifice cycling was instituted. Approximately nine orifices were cycled per day and allowed to run for at least 24 hours. (Note: There are 2 orifices per gatewell slot, 3 gatewell slots per turbine unit.) A total of 106 orifices were cycled under this program from 6 May through the end of the season.

Since 1978, a wooden bypass flume has been used at McNary to collect and transport fish. This flume is 1200-feet in length, 5-feet wide, 5-feet deep and carries water and fish to a 20-inch metal downwell pipe for transport to the fingerling facility. Approximately 200 to 400 cfs of water is dissipated through 85 flume screens along the channel. The downwell pipe carries about 25 cfs of water to the facility.

The flume has inherent problems which are: 1) 90° orifice elbows that provide undesirable hydraulic conditions and plug with debris; 2) flume screens that constantly pluy with debris and impinge small fish; 3) uneven water dissipation along the bypass channel; and 4) safety problems. Negative effects on fish include a possible increase in descaliny and mortalities due to impinging on the flume screens. Also, it was found that nearly 30% of the fish were in the flume for more than 8 hours indicating a holdup problem exists (Park et al. 1981). Adult shad accumulating at the end of the flume during July and August create a barrier which the O-aye fall chinook are reluctant to swim through.

The 20-inch bypass pipe from the flume to the upwell/separator has been suspected of injuriny fish. There are several 90° bends, a reducer cone, and a pinch valve in the bypass pipe. Debris is believed to hang up at these points. On 4 May, a large blockage removed itself from the pinch valve. This occurrence alerted facility personnel to the potential for severe fish injury in the bypass pipe. In an attempt to flush debris, the project periodically opened the pinch valve. On several occasions large amounts of debris and fish were noted exiting the upwell immediately after flushing.

Modifications to barge and truck loading facilities were made in 1982. An open flume for truck loading replaced the old 6-inch pipe system. Loadiny time was effectively reduced and fish experienced less stress during crowding. Also, an open flume eliminated the tendency for fish to hold in the closed pipe system. Clear sections of PVC pipe were incorporated into each barge loadiny line to allow debris detection as well as a more efficient barge loading operation. A new hand crowder made barge loading from the portable raceways easier. A small boom was installed to handle the barge loading line.

No separation of fish by size or species occurred. Separator bars were spaced evenly 1-1/4 inches to allow smolts to swim between the bars. The separator still excluded larger nonsalmonid fish and adult salmonids. The wider spaced bars were replaced at mid season with 3/4-inch bar spacing which separated the smaller fall chinook from the adult American shad. This operation worked well, and the two bar' sizes will be interchanged for spring and summer migrants annually. The 6- X 12-inch orifice provided an improved exit from the separator, in contrast to 1981, when 4-inch orifices were regularly plugged. A light was also placed at the orifice to encourage fish to exit from the hopper. It is believed that this operation decreased the number of fish holding in the wet separator, an improvement over a nonlighted orifice.

Beginning on 13 April, descaling rates were checked routinely on all species whenever adequate numbers were available. Generally, 100 fish were obtained to provide a reliable sample. A high descaling rate on spring chinook salmon was a major concern. From 13-26 April, descaling ranyed from 10.6 to 39.1%. The seasonal average was 17.9% for the spring chinook salmon which was over twice the Lower Granite rate, 8.2%, but substantially less than the 26.0% rate experienced at Little Goose. Fall chinook salmon migrants had a seasonal descaling average of 8.0%, almost twice the 1981 descaling rate of 4.3%, but overall quality of fall chinook migrants (1982) was better than experienced in 1981.

There are several factors which can affect descaling rates and fish condition at McNary. They are: 1) descaled fish entering the system; 2) plugged or partially plugged orifices; 3) contact with screens, including STS, barrier, bypass flume, or perforated plate screens; 4) contact with debris or bottlenecks in closed conduit pipe system; and 5) debris lodged in counting tunnels.

Modifications of the bypass flume, wet separator and the bypass pipe from the flume to the separator should alleviate some of the problem areas.

Benefits of 1982 Operations

An estimated 7.2 million smolts arrived at Lower Granite Dam of which 3.0 million (42%) were transported from Lower Granite and Little Goose dams to release sites below Bonneville Dam. No estimates of numbers passing Priest Rapids Dam were obtained. An estimated 14 million smolts arrived at McNary Dam, of which 3.0 million (21%) were transported. A total of over 10.0 million nontransported fish were estimated to have survived to John Day Dam. The combined transported/nontransported total of 15.81 million fish surviving to the lower river is slightly higher than the 15 million estimated in 1981, and about the same as the 16.4 million estimated in 1980 (Table 13). The largest group of fish represented in these totals are subyearling chinook salmon for which no expansion equations have been developed for estimating populations at John Day Dam.

Therefore no confidence limits about the estimates are available. Expansions are based on the yearling chinook expansion equations. The yearly estimates are useful though, in that they provide year to year comparisons of relative numbers of nontransported smolts to the lower river (Note: estimates to the lower river for the years shown are estimated numbers to John Day Dam; there is no present sampling of juveniles below that point where reliable estimates of magnitude of nontransported fish can be made).

The 8.2 million summer migrating juveniles to the lower river was the highest since NMFS began making estimates in 1976. By comparison, there were 6.2 million in 1981, 4.4 million in 1980, and 3.0 million in 1979. High flows and spill through most of July may have substantially contributed to the success of these migrations. (See Summer Operations for additional details).

By contrast, the 7.9 million spring migrating smolts to the lower river was the lowest since the 1977 drought year (Table 13). As discussed previously, much of the decline probably resulted from a combination of a recent low yearling chinook salmon outmigration from the Snake River, low survival of nontransported yearling chinook salmon possibly resulting from poorer quality of smolts released from hatcheries, and potential mortality from descaling problems associated with passage at Snake River dams.

Status of Upriver Adult Runs

In recent years, poor freshwater and saltwater survival and intense ocean exploitation have contributed to declining runs. The 1982 upriver adult

Table 13.--Number of transport and nontransported outmigrants from areas above McNary Dam to the Columbia River, 1976-1982 (million of smolts)[a]

	1976			1977			1978		
	Transport	Nontransported	Total	Transport	Nontransported	Total	Transport	Nontransported	Total
Chinook 1's	0.75	2.20	2.95	1.36	1.02	2.38	1.60	2.60	4.20
Chinook 0's	0	2.50	2.50	0	0.95	0.95	0	3.60	3.60
Steelhead	0.44	1.15	1.59	0.90	0.12	1.02	1.40	0.60	2.00
Sockeye	0	0.70	0.70	0	0.75	0.75	0	1.30	1.30
Coho	0	0.11	0.11	0	0.20	0.20	0	0.80	0.80
Total	1.19	6.66	7.85	2.26	3.04	5.30	3.00	8.90	11.90

	1979			1980			1981		
	Transport	Nontransported	Total	Transport	Nontransported	Total	Transport	Nontransported	Total
Chinook 1's	2.61	2.40	5.01	4.85	3.39	7.44	2.68	1.55	4.23
Chinook 0's	0.50	2.50	3.00	0.65	3.72	4.37	2.10	4.11	6.21
Steelhead	1.89	0.47	2.36	3.07	1.04	4.11	3.11	0.50	3.61
Sockeye	0.20	1.82	2.02	0.05	0.30	0.35	0.31	0.54	0.85
Coho	0.08	0.21	0.29	0.03	0.06	0.09	0.10	0.06	0.16
Total	5.28	7.40	12.68	7.85	8.51	16.36	8.30	6.76	15.06

	1982		
	Transport	Nontransported	Total
Chinook 1's	1.38	1.77	3.15
Chinook 0's	1.83	6.60	8.43
Steelhead	2.62	1.21	3.83
Sockeye	0.17	0.66	0.83
Coho	0.06	0.05	0.11
Total	6.06	10.29	16.35

a/ Transport numbers--below Bonneville Dam. Nontransported numbers--estimate number of downstream migrants passing John Day Dam.

spring run of 70,000 showed a slight improvement, but was still the fifth lowest on record and well below the 1972-81 average of 105,600. The Ice Harbor Dam fish count of 14,300 adult spring chinook was slightly below that of 1981, but nearly double 1980 and 1981 counts into the Snake River. The adult spring chinook run into the mid-Columbia above Priest Rapids Dam was only 8,700, down considerably from the 10 year average of 12,000 and similar to runs during the 1960's and early 1970's. No commercial or recreational fishing for upriver spring chinook was allowed in the mainstem Columbia River during 1982 due to the expected poor run. Approximately 1,300 spring chinook were harvested by treaty Indians while ceremonial fishing, and about 40 fish were taken commercially during the winter season.

The 1982 adult summer chinook run established a record low of 20,100 fish, slightly below the 1981 run of 22,400, and well below 50,000 for the tenth consecutive year. The Snake River escapement at Ice Harbor Dam of 4,300 adult chinook was the fourth lowest in history, while the mid-Columbia run over Priest Rapids of 8,800 was a record low. The mid-Columbia run had sustained itself at a constant level until this year, but now joins the Snake River run at a similar low level. A small incidental catch of summer chinook occurred in the commercial shad season below Bonneville Dam, but otherwise no commercial or recreational fishing was allowed in the mainstem Columbia River because of the poor run.

The upriver adult fall chinook run of approximately 200,000 fish was above the recent 5 year average, primarily due to the strength of returns to the Bonneville Pool Hatcheries. The McNary count was 31,100 fish, the best in 3 years but still below the escapement goal of 40,000.

Sockeye salmon again fared poorly in 1982. The sockeye run over Bonneville Dam was 50,200 fish, still only about one-half that needed for escapement. The production of sockeye is limited by their freshwater spawning and rearing habitat requirements, which are provided by only two river systems in eastern Washington. No commercial fishing for sockeye has been allowed since 1972. The first significant sockeye catch by anglers on the Columbia River since 1971 was observed in June and July when catches of 60 and 20 were recorded.

The 1982 Bonneville count of 55,800 coho salmon was a record hiyh while the jack count of 17,940 was the sixth lowest. The majority of the harvest of coho occurs below Bonneville in the river gill net fishery and ocean fisheries. In recent years, the lower Columbia River commercial fishery has been closed during the peak of the upriver coho migration in an attempt to meet court-ordered "upriver bright" fall chinook allocation to the Indian Treaty commercial fishery. The Treaty commercial catch was 3,800 fish, above average for the Indian fishery. The small size of the coho ordinarily precludes being caught in the 8-inch minimum mesh size nets required of the fishermen to protect steelhead.

The 1982 upriver summer steelhead count over Bonneville Dam was 157,600, above the lo-year average of 139,100 (Table 14). The summer steelhead run was approximately 161,800 with the addition of sport catches. Approximately 72,800 steelhead were counted over Ice Harbor, more than double the 10 year average of 33,100. A total of 68,400 steelhead were recorded over Lower Granite.

The American shad run continued at a high level with a count of 1.1 million fish at The Dalles Dam. This was equal to that of 1981 and third highest on record. The shad run is greatly underharvested because bf poor market conditions and a reduced and strictly regulated gillnet fishery that must be timed early to avoid impacting runs of summer chinook , sockeye, and steelhead.

Special Tests and Studies

Lower Granite Dam

STS guidance--Over the last several years, the data obtained by Sims at Lower Granite Dam has shown that collection of yearling chinook salmon has been consistently lower than collection of steelhead. A study was undertaken in 1982 to determine if these data were correct and if so, what was the cause--guidance, orifice passage, turbine outages, etc.

TABLE 14 BONNEVILLE DAM
FISH COUNTS 1982

Month	Spring Chinook Adult	Spring Chinook Jacks	Summer Chinook Adult	Summer Chinook Jacks	Fall Chinook Adults	Fall Chinook Jacks	Coho Adults	Coho Jacks	Sockeye	Steelhead	Shad
March	306	6								1,239	
April	29,768	514								4,188	1
May	39,937	5,513							12	5,335	6,888
June			11,925	3.514					20.731	8.636	655.037
July			8,204	2,971			54	25	29,207	39,159	117,325
August					21,982	12,076	2,500	1,178	257	51,329	914
September					128,744	45,604	48,450	7,293	4	44,456	37
October					6,887	4,600	4,494	8,638	1	3,140	9
November					161	100	328	806		162	1
Season Total	70,011	6,033	20,129	6,485	157,774	62,380	55,835	17,940	50,212	157,644	780,212
lo-year Average	105,600	7,100	36,600	8,700	151,400	57,000	26,400	19,800	54,700	139,100	592,000

a/ 1 March to 31 May.
b/ 1 June to 31 July.
c/ 1 Auyust to 15 November.
d/ 1 March to 15 November.
e/ Additional numbers of shad proceed upriver via the Bonneville navigation lock. Thus the shad count at The Dalles Dam on 1.1 million more closely represents the minimum number ascending the river beyond Bonneville Dam.

Source: ODFW/COE

Guidance measurements were obtained from comparisons of catches of fish in gatewells, with catches of fish in fyke nets fished below the STS. Research completed verified that Sims was correct and that lack of guidance was the main problem. Average fish guiding efficiency in yearling chinook salmon was 50% compared to 75% for steelhead.

STS Cycliny--An STS cycling operation would reduce operation and maintenance costs considerably, and logically increase the reliability of STS operations. A study at Lower Granite and McNary dams was conducted to determine if a cycle at 1.5 min. on and 20 min. off would adversely affect juvenile salmonids. Criteria for evaluation was established to determine if there was an increased impingement of fish on the screen, an increase in descaling, stress on fish, or reduced fish guiding efficiency. Test results on yearling fish indicated no adverse effects. Tests on subyearling fish were inconclusive. Similar results were obtained at McNary Dam using yearling fish but there was some increase in impingement with subyearling fish. From these results, the fishery agencies tentatively recommended that STS could be operated intermittently, 10-15 min. off and 2 min. on during the yearling smolt miyrations at each dam, normal operations during the major subyearling chinook salmon migration, and intermittent operations during remaining months whenever STS operations are needed.

Ice Harbor Dam

Biosonics, Inc. under contract with the COE, studied the effectiveness of the ice and trash sluice in passing juveniles at Ice Harbor Dam. Evaluation was based on proportion of those passing the powerhouse, passing throuyh the sluiceway as determined from hydroacoustic samplings. Results generally indicated a sluiceway efficiency of 12 to 20%, far below that determined to be an effective bypass. The high spill however, made it difficult to assess actual efficiency. Additional studies are planned in 1983 to better define the potential of the sluice as a bypass at Ice Harbor Dam.

McNary Dam

Research was undertaken to further define criteria for the John Day Bypass. The research was conducted at McNary Dam because a bypass with STSs and orifices was in place, and could be used for prototype testing. Research during 1982 was directed specifically towards: 1) determining if a sinyle or dual level orifice system would be necessary for acceptable orifice passage efficiency (OPE) throughout the range of submergences expected at John Day Dam; 2) determining if STS fish guiding efficiency (FGE) will be adversely affected by the use of a balanced flow vertical barrier screen (BFVBS); and 3) evaluating the benefits of the BFVBS for improving OPE.

A total of 23 STS FGE tests and 54 OPE tests were conducted between 21 April and 20 July.

STS FGE Tests--The presence of the BFVBS did not significantly alter STS FGE with the John Day gatewell flow condition for spring chinook salmon or steelhead. The average FGE for three replicates was 88% (89% in 1981) for spring chinook salmon and 87% (83% in 1981) for steelhead.

FGE tests with fall chinook salmon were conducted during late June throuyh July. Results were significantly lower than for spring chinook salmon. An average FGE for six replicated tests was 52%. A series of FGE tests with fall chinook salmon for a standard McNary Dam gatewell (operating yate in normal position) and a BFVBS also resulted in lower FGE. The results of the individual tests ranged from 37% to 60%, with an average of 52%.

OPE Data--Levels of OPE for gatewells equipped with BFVBS, were generally acceptable (77%) through the range of orifice submergences and heads tested, provided that OPE was measured for a 48-h test period and the orifices backlighted. This is in contrast to the less than acceptable OPE measured with a standard vertical barrier screen in 1981.

Juvenile Radio Tracking--Research conducted in 1982 continued the work begun in 1980 designed to evaluate the behavior of smolts in the John Day forebay for various modes of spill and powerhouse operation.

Radio tagged salmonid smolts were observed as they moved from a release site 3 km upstream from John Day Dam until they passed through the dam, Their behavior between the release site and passage location at the dam was evaluated in relation to simultaneous hydrological conditions at the dam and flow meter data from the forebay.

Forty-three fish equipped with radio tags were released between 10 April and 20 June, and 26 were tracked to the dam. One fish apparently passed through the navigation lock, 12 through the spillway, and 13 through the powerhouse. Of those fish not reaching the dam during the tracking period, five were terminated due to a lack of downstream movement, eight were lost after tracking for periods that ranged from less than 1/2 hour to 6 hours, and four were lost immediately after being released.

The six fish released to obtain diel passage behavior followed the patterns established during previous sampling at the dam. Three fish were released during the early afternoon. Two of these fish made only minor downstream progress, whereas the other, which was released during the peak of the outmigration, moved steadily downstream and passed through the dam during daylight. The three fish released just before sunrise moved downstream to the restricted zone but did not pass until the next morning. Two fish were released after dark, and they moved straight down to the dam--one passed through the spill, and the other was lost just inside the restricted zone.

By combining the tracks from 3 years of tracking juvenile salmonid smolts in the John Day forebay, 37 juvenile salmonids were tracked to the dam from 3 km or more upstream. Nineteen (51%) passed through the powerhouse powerhouse, and 17 (46%) passed through the spillway. One fish was last heard at the upstream gate of the navigation lock and is believed to have passed downstream through the lock.

In 1980-81, spill was not started until after sunset. Six fish approached the dam during zero spill periods, four (67%) of these passed throuyh the powerhouse.

When the spill was between 10 and 30% of the total flow during the fish's approach, the distribution of fish was nearly the same for each side of the river, yet 75% of the fish passed through the powerhouse. When spill exceeded 30% of the river flow, 11 out of 14 (80%) stayed on the spill side of the river.

Flow-Net Relationships--The objective of this research program is to define the John Day forebay flow-net over a range of flow conditions, and dam operations, and relate it to smolt passage behavior. Such information is fundamental in assessing the effectiveness of providing special flows and dam operations, and may also be useful in the design of fingerling bypass systems.

From 13 May to 3 November 1982, 12 self-contained, magnetic recording current meters (Interocean Systems, Inc., model 135,) were deployed in John Day forebay. The meters are secured to a self-adjusting buoy system which maintains them at a constant depth 3 m below the surface of the reservoir. Eleven of the meters were positioned in one of two parallel lines which span the length of the powerhouse and spillway, approximately 115 and 365 m from the face of the dam. The 12th current meter was stationed approximately 600 m from the dam and 100 m from the Oregon shore.

Cassettes with coded data are read into a computer via a digital cassette reader. The tape reader has minimal translating capabilities and merely transfers the coded data into the mainframe. No software was provided by Interoceans Systems, Inc., thus the extensive and sophisticated programs necessary to process and analyze the data must be developed by programmers in conjunction with the Biometrics Unit at Northwest and

Alaska Fisheries Center. Most of 1982 was spent developing the programs and debugginy the system. Once these proyrams are completed, the current meter data will be meshed with the Columbia River Operational Hydronet and Manayement System (CROHMS) and dam operations data.

Inspection of some of this year's data, confirms that the current meters are effective in detecting changes in forebay currents. On 29 May 1982, current velocities increased from 20 to 25 $cm \cdot sec^{-1}$ at position 10 (center of spillway, 365 m from the dam), as spill levels increased from 150 to 180 kcfs at 0700 with a river flow of 340 kfcs (Figure 22).

Three months later, on 20 August, no spill was occurring and river flow had dropped to 205 kcfs. These conditions resulted in an overall decrease in current velocity from the 29 May levels and a concomitant shift in current direction away from the spillway towards the powerhouse. The increase incurrent velocity from 0 to approximately 12 $cm \cdot sec^{-1}$ on 20 August shown in Figure 22 appears to be a consequence of increased power generation which typically occurs during the morning and evening hours.

Summer Flow Studies--Research started in 1981, was continued in 1982 to define the effect of flow on the migratory behavior and survival of juvenile fall and summer chinook salmon in John Day Reservior. The objectives of this research were to: (1) define the effects of in-stream flow on the passage time of subyearling chinook salmon in John Day Reservoir, (2) define the relationship between reservoir passage time and the survival of subyearling chinook salmon in John Day Reservoir, and (3) define the effect of instream flow levels on the distribution and behavior of subyearling chinook salmon in John Day Reservoir.

There was no statistically significant evidence to indicate that instream flows affected the rate of movement or residence time of subyearliny chinook salmon in John Day Reservoir in 1981. Data collected in 1982, when combined with the 1981 data, ayain showed no relation between instream flows and movement of subyearling chinook salmon.

POSITION 10

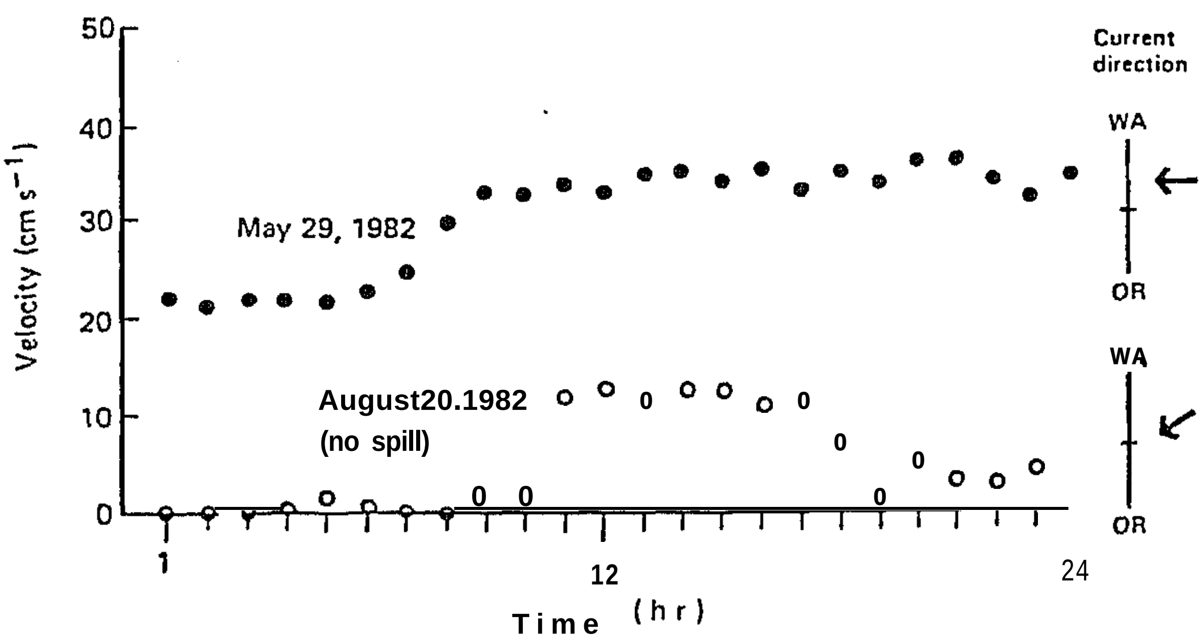

Figure 22.-Mean hourly current velocity at position 10 (center of spillway, 365 m from dam) on two different dates. For each day the net current direction with respect to the dam (vertical line) is depicted to the right of the graph.

Bonneville Dam

Downstream Migrant Facilities--The startup and initial function of the collection and downstream passage system was monitored to identify potential problems with the system prior to a comprehensive evaluation scheduled for the spring of 1983.

Construction work on the 2nd powerhouse at Bonneville Dam extended through the 1982 fingerling migration period. In addition, high river flows during the spring and summer of 1982 necessitated the spilling of excess water throughout this period. These two factors influenced the results of the preliminary studies. Of the test fish released on 23 April, 0.37% of the fish released into the tailrace and 0.39% of those released into the gallery downwell were recovered at Jones Beach (Rkm75)--not a statistically significant difference. Consequently, it was concluded that those fish entering the downwell in the gallery were transported downstream from the second powerhouse, and survived as well as those released directly into the tailrace. Apparently, there were no obstructions that would adversely affect juvenile survival in that portion of the system.

The 10% sampler was exceptionally accurate, of 2,231 marked test fish released into Gatewell 18B, 9.9% were recovered by the sampler. Approximately 6% of the fish recovered were descaled.

Gatewell dipping of unmarked fish in the 1st and 2nd powerhouses showed wide variation in descaling between species with averages ranging from 7 to 17%.

During 938 hours of operation, 8,927 fish were obtained from the 10% sampler. Subyearling fall chinook salmon were captured,most frequently and had the lowest rate of descaling (4.4%), whereas sockeye salmon were captured less frequently, however, they sustained the highest rate of descaling (48.9%).

Adult Facilities--Fish passage was evaluated by the Corps ofEngineers Portland District Fisheries Management Unit in 1981 by analysis of fish ladder counts (Ross, 1982). A similar fish passage evaluation was conducted in 1982 from 1 April to 30 September. In addition, a radio tracking program was conducted to identify passage problems so that corrective measures could be made and tested to pass migrating fish safely and efficiently past the Bonneville project.

The objectives of the study were to:

1. Determine if fish using the new second powerhouse fishways are being injured (fresh, open wounds) and/or delayed by the new facilities, if so, where such injuries or delays occur.
2. Determine migration routes, holding/milling areas and fishway preferences.
3. Determine test fish passage times to establish the extent of delay.

Injury rates (fresh, open wounds) were 1.0% of all fish counted at the Washington Shore ladder, 1.0% of the UMT channel and 1.8% at the Bradford Island ladder from 1 April to 31 May 1982. These injury rates are lower than in spring 1977 (Duncan, unpub. data), or 1981 (Ross, 1982), the only years there are fish injury rate data for the old and new Washington shore counting stations.

Fish counts at Bonneville showed that 60.0% (51,154) of the adult salmonids used the Washington shore fishways and 40.0% (34,113) used Bradford Island fishways. The percentage of Bonneville salmonid passage via the UMT channel was 43.5% (37,110) and the percentage via the UMT channel was 72.5% of the Washington shore. In 1980 (old Washington shore) and 1981 the percentage of total Bonneville adult salmonid passage at Washington shore was 40.7% and 39.6%, respectively.

Fifty adult spring chinook were radio tagged between 14 April and 31 May 1982. Forty-one passed over Bonneville Dam during the spring chinook season. Maximum mean passage time (elapsed time from downriver release to fishway exit) was 106.7 hours (median = 118.2, range 19.5 - 336.8 hours, N=41). Maximum mean passage time for radio tagged fish in 1978 at the Bonneville first powerhouse was 95.9 hours (median = 71.6, range 7.1

- 434.4, N=61, Johnson, 1979). Minimum passage times (elapsed time from when a fish was first found in the study area to fishway exit) indicate only the fastest possible passage time for each fish - most fish probably took lonyer to pass the project. Minimum mean passage time was 44.7 hours (median = 27.7, range 2.4 - 241.7, N=37).

Of the 41 tagyed fish that passed over Bonneville, 10 (24.4%) fell back past the project. One of the 10 fish fell back twice and successfully re-ascended. Two fallback fish were tracked in the study area after fallback and subsequently went downstream out of the study area. One fish fell back that exited the Washington Shore fishway; 9 had exited Bradford Island.

Ladder use by radio tagged fish, including ladder ascents by fish that fell back, approximated adult chinook ladder use shown by fish counts. Ladder passage times for tagged fish that passed through the ladder only duriny the day were substantially different than ladder times of fish that spent part or all of the night in a ladder. Passage times for fish that used "A" Branch ladder in spring 1978 averaged 2.9 hours (range 1.5 -5.3, N=21, Johnson, 1979). Data are not available for "B" Branch ladder during the spriny; a field data logger was not available June 1982.

Ladder fallouts, fish that entered the lower ends of fish ladders and fell back out, occurred as often at the second powerhouse ladder as at "A" Branch and Cascade Island ladders combined. Twelve of the 13 fallouts (92.3%) used other ladders to ascend Bonneville Dam. Six of the 13 chinook that fell out of the second powerhouse fishway passed over Bonneville via the Cascade Island - UMT channel fishway.

A raw data frequency distribution of the total number of two-minute intervals spent in grid cells by all fish tracked in the Bonneville study area was made. It showed one holding/milling area in the second powerhouse tailrace in the larye eddy in the upstream half of the second powerhouse tailrace near the south shore. Another holding/milling area was off the western end of Cascade Island on the second powerhouse tailrace side.

PUD Studies

System Monitoring--A study was conducted to estimate the survival of downstream migrant spring chinook in the mid-Columbia River. Study objectives and criteria were established by the mid-Columbia Studies Committee. The study consisted of marking approximately 425,000 spring chinook smolts at the Leavenworth Hatchery, releasing these fish at four locations in the mid-Columbia Reach and recovering them at McNary Dam. Estimation methods are presented for calculating the survival rates for the mid-Columbia Reach and the segments above and below Rock Island Dam.

Based on the marking and recovery information, the Pateros to Priest Rapids Dam tailrace survival rate was estimated to be 45%. The Pateros to Rock Island and Rock Island to Priest Rapids survival estimates were 67 and 68%, respectively. It was assumed that within each of these sections each project had equal effect on survival and a per project survival rate of 87% was estimated for Wells, Rocky Reach and Rock Island and 83% for Wanapum and Priest Rapids.

Douglas PUD

1. Two-Dimensional Model Tests

Hydro Research Science, Inc., conducted two-dimensional model tests of downstream migrant bypass concepts for Wells Dam. The objective of the model testing was to assist in determininy the feasibility of altering inflow patterns at the hydrocombine. Structural modifications were tested to provide information for the design of potential prototype bypasses.

2. Preliminary Prototype Bypass Testing

Preliminary testing of two prototype bypass concepts was undertaken at the Wells Hydrocombine in July. Water velocities in front of the prototype bypasses were measured at various spillway and turbine discharges. Preliminary testing was conducted to provide information on equipment needed to evaluate prototype bypass concepts and to compare prototype results with those seen in the two-dimensional model studies.

3. Steelhead Imprinting/Transport Study

The first year of a 2-year marking program for a steelhead imprinting/transport study was completed in 1982. Juvenile steelhead from Wells Hatchery were released into an irrigation ditch fed by Methow River water near Twisp, Washington. The steelhead were allowed to migrate 6 miles downstream voluntarily and were collected. Two groups of steelhead were marked. The control group was released into the Methow River at the collection site and the experimental group was transported below Priest Rapids Dam on the Columbia. Initial adult recoveries are expected in the fall of 1983. Preliminary information from recoveries of juveniles at McNary and John Day Dams indicates that survival was enhanced by transporting the fish around the five dams. Survival of those released at Priest Rapids Dam was about twice that of the release in the Methow River.

Chelan PUU

Two studies of fish behavior were conducted at Rocky Reach. The District contracted with Biosonics, Inc., to conduct hydroacoustic studies of fish distribution in the powerhouse forebay area and in the turbine intakes. The primary objectives of this study were' to determine the vertical distribution of smolts as they enter and pass through the turbine intakes and the horizontal distribution of smolt passage across the powerhouse. The results ofthis study will be used in the development of' permanent smolt bypass facilities.

An evaluation and feasibility study of a static smolt guidance net was conducted' at Rocky Reach Dam. The objective was to determine if static guidance devices in the powerhouse forebay showed potential as an alternative method for permanent fish guidance and bypass facilities.

These studies were conducted in accordance with the FERC Settlement Agreement with Studies Committee involvement and approval. The reports of study results are in preparation and will be available in early 1983.

Two studies of fish migratory behavior were undertaken at Rock Island in 1982. Hydroacoustic studies of fish distribution in the powerhouse forebay area and turbine intakes were conducted at Rocky Reach Dam. The primary objectives of this study were to determine the vertical distribution of smolt passage across the powerhouse. The results of this study will be used in the development of permanent smolt bypass facilities.

Studies of the collection efficiency and operating characteristics of the 2nd powerhouse fingerling bypass system were conducted by CH2M Hill for the District. Objectives for this year's study were to detemine collection efficiencies for spring chinook salmon and steelhead and obtain a second year of data on coho salmon to compare with the 1981 study. Also, the fish migration was sampled to provide timing data for COFO and District use in providing spill and flows for downstream migrants.

These studies were conducted in accordance with the FERC Order Settlement Agreement with studies committee involvement and approval. The reports of study results are in preparation and will be available in early 1983.

Grant PUD

FERC Spring Studies--Spring studies conducted in 1982 (third year of Settlement Agreement) continued to emphasize horizontal and vertical distribution, and abundance and approach patterns of downstream migrating juvenile salmonids at mid-Columbia dams. The following is a list of Grant County PUD studies initiated, participated in, or completed in 1982. The Studies Committee conducted separate meetings with each PUD and the list of studies for other PUDs is not included.

1. Gatewell Monitoring at Priest Rapids and Wanapum - PMX, GPUD
2. Hydroacoustic Studies at Priest Rapids - BioSonics, GPUD
3. Hydroacoustic Studies at Wanapum - Biosonics, GPUD
4. System Mortality Test - 1982 (Joint PUDs) - Chapman, PMX, BNW
5. Physiological Monitoring of Smolting Fish (Joint PUDs) - PMX

FERC Vernita Bar Studies--This marked the third year of Vernita Bar Studies under the Settlement Agreement. Studies were concentrated on impacts of flow fluctuations on spawning, redd exposure, egg and fry survival and emergence. Ongoing activities were environmental conditions, aerial redd counts and aerial photography. The continued assistance of water management groups under COFO during critical flow periods is an important part of the study effort.

Dissolved Gas Monitoring

Dissolved yas pressure and water temperature data were collected and recorded in the forebays of Ice Harbor, McNary, John Day, and The Dalles projects under the direction of the COE during the period 14 April to 3 August. Tensiometer readings were telephoned daily by project personnel and fisheries agency staff to the COE. This information was used by the Smolt Coordinator and Reservoir Control Center in coordinating distribution of spill to prevent fish from being killed or harmed by high levels of dissolved gases. Higher spills and total flow were experienced this year, making the yas monitoriny program more important.

Infrequent sampling of dissolved yas levels was accomplished at Priest Rapids Dam, Rocky Reach Dam, and Grand Coulee Dam by the respective project operators. Readings were reported to the Smolt Coordinator and the information was used to assist in making spill management decisions.

In addition, dissolved gases were measured at Prescott by NMFS duriny the spring migration using the gas chromatoyraph technique. The range of dissolved gas readings at the monitoring sites during the period 14 April to 3 August was as follows:

Ice Harbor	: Highest = 127.9% (5 Jul)
	: Lowest = 112.0% (14 Jul)
McNary	: Hiyhest = 128.6% (19 Jun)
	: Lowest = 110.1% (6 Jun)

John Day	: Highest = 127.7%	(25 Jun)
	: Lowest = 102.6%	(3 Aug)
The Dalles	: Highest = 131.1%	(31 May)
	: Lowest = 101.4%	(2 Aug)
Rocky Reach	: Highest = 127.0%	(22 Apr)
	: Lowest = 104.0%	(3 Jun)
Priest Rapids	: Hiyhest = 128.2%	(31 May)
	: Lowest = 111.4%	(4 Jun)
Prescott	: Highest = 126.6%	(30 Mar)
	: Lowest = 105.2%	(6 Apr)

Althouyh considerable difficulty was encountered in maintaining accurate readings with the instrument at Ice Harbor Dam, the Ice Harbor percentages generally indicate the range of dissolved gas that moved downstream from the Lower Snake River into the McNary reservoir and from there passing through the other three projects. Changes in the gas values at each project were usually related to the total amounts of water released and spilled from the upstream dams. Note the very small differences between each project in the highest and/or lowest gas percentages for 1982. Dissolved gas levels generally exceeded the Federal criteria (110.0%), but there were no reports of gas bubble problems in the migrating fish during the spriny and summer migration periods. The only incidence of gas bubble disease symptoms in migrating fish was reported at Jones Beach where yearling chinook were observed with symptoms on March 29. When tensiometer readings exceeded 125% in The Dalles forebay, yearliny coho that were beiny held in shallow tanks exhibited gas bubble disease symptoms. At that same time miyrating fish collected at The Dalles were not exhibiting symptoms.

Section V

POWER SYSTEM IMPACTS

Studies conducted prior to the fish flow operation indicated better than 95 percent confidence of meeting all firm loads, providing fishery recommended minimum flow requirements and refilling reservoirs at Columbia and Snake River Projects. The studies also indicated nearly a 95 percent confidence of meeting fishery recommended optimum flows at Columbia River Projects and flows at a level half way between fishery recommended minimum and optimum levels at Snake River Projects and still meet firm loads and refill reservoirs. Based on these studies, operating ayencies agreed to provide fishery recommended optimum flows during the 1982 spring fish migration period in the Columbia and near optimum fishery flows in the Snake. Spill requests at Federal Projects were to be coordinated between the fishery agencies and the COE. BPA also agreed to deliver energy that would be spilled on the Federal system to the PUDs for immediate spill to enhance spill at PUD projects and/or to lower dissolved gas in the lower Columbia River.

Spring flood control operations of the Federal Columbia River Power System provided sufficient water for both power and fish flow operations. More than the fishery recommended optimum flows were provided at Columbia River hydroelectric facilities throughout the spring outmigration. However, due to limited storage capacity on the Snake River, there were periods when flows dropped below fishery agency recommended levels (see Table 15).

BPA took several actions to reduce dissolved gas levels in the lower Columbia and to enhance spill at mid-Columbia Projects. BPA began delivering unmarketable energy to the PUDs on April 17 to enhance spill. Duriny periods in May and June when high flows and spills produced dangerous dissolved gas levels, BPA at the fishery ayencies' request delivered energy to various utilities off the mainstem Columbia for spill. Spill reduction was also achieved through the use of existing storage agreements with utilities within and outside of the region.

Table 15.--Fishery agencies requests vs actual flow in KCFS

	Priest Rapids		Lower Granite		McNary	
Period	Request	Actual	Request	Actual	Request	Actual
19-25 Apr	100	159.3	120	107.9	215	276.7
26 Apr-2 May	120	134.1	120	122.0	245	261.2
3-9 May	140	181.0	120	124.6	290	304.1
10-16 May	140	180.9	120	119.7	290	300.7
17-23 May	140	208.3	120	161.8	290	376.5
31 May-26 June	120	192.2	120	122.5	250	322.1
7-13 June	120	186.4	120	116.5	250	309.8

These agreements were not used earlier as BPA followed all spill priorities until the fisheries agencies requested the spill reductions. This was apparently quite successful as the fisheries agencies reported that there was very little damage to fish due to dissolved gases. Nearly three million megawatt hours of federal energy was supplied for immediate spill.

1982 Federal Revenue and Energy Gains and Losses

Due to the high runoff during 1982, BPA was able to serve nearly all available markets from mid-February through the 1982 fish flow operation. The only losses imposed on the Federal Columbia River Power System due to the fish operation during this period were due to the requirement for special discharges at Lower Granite and Little Goose to enhance collection operations and limited use of turbines for fisheries-related studies. During the period December throuyh mid-February, marketable energy was held above energy content curves to be used during the spring migration period. Due to the high flows after mid-February, this energy was spilled. Actual losses are reported in the following table.

1982 Energy and Revenue Gains and Losses - Federal System

	Power only operation 1000's MWH	Fish flow operation 1000's MWH	Net gain or (loss) due to fish flow operation 1000's MWH
Energy yains & (losses) December-July 18			
Energy spilled1/	(18.184.1)	(20,496.6)	(2,312.5)2/
Total gain or (loss) due to fish flow			(2,312.5)
Energy marketed & stored	66,935.5	64,623,0	(2,312.5)
Total gain or (loss) due to fish flow			(2,312.5)
Revenue gains & (losses) December-July 18			81,000's
Energy spilled			(13,895.6)3/
Energy marketed	(All occurred as energy spilled)		
Total gain or (loss) in revenue due to fish flow			(13,895.6)

1/ Includes eneryy delivered to non-Federal utilities for immediate spill plus controlled and uncontrolled spill.

2/ The major portion of the spill loss due to fish flow (2,263,000 MWH) was a result of marketable energy beiny held above ECC for fish flows. The remaining 49,469 MWH resulted from fisheries requested special loading of projects with collection facilities.

3/ Revenue losses based on 2,263,000 MWH at 6 mills/kWH and 49,469 MWH at an average price of about 6.42 mills/kWh.

1982 Eneryy Gains and Losses at Non-Federal Projects

Information needed to assess energy losses and gains that were attributable to the fisheries operation was not available for Private and public utility projects in 1982.

IMPLEMENTATION PROCEDURE

FOR THE

1982 FISHERY OPERATION PROGRAM

Committee on Fishery Operations
February 16, 1982
As modified

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PREFACE

The Committee on Fishery Operations (COFO) will coordinate a fish program in 1982 to provide the maximum protection of juvenile fish past the mainstem Columbia and Snake River dams with minimum loss of power or adverse impact on other uses of the water resource.

The mid-Columbia PUD's will operate their projects in accordance with the FERC order approving the settlement agreement between the PUD's and fishery agencies. The agreement requires that the PUD's maintain certain operating requirements over a 5-year period commencing in 1980. The PUD's in cooperation with the fishery agencies will conduct studies under the terms of the agreement to determine the effects of the projects and their operation on downstream migration of juvenile salmonids, methods to reduce juvenile mortality and methods of improving and increasing salmonid production in the mid-Columbia reach. A copy of the agreement is included as Attachment 1.

The Corps will provide protection to smolts migrating past their projects. This includes interim transportation of smolts from Lower Granite, Little Goose, and McNary Dams and interim spill at dams without adequate bypasses. In addition, the Corps will fund studies to develop efficient fingerling bypasses in order to reduce the need for spill, optimize the use of interim spill and improve techniques for smolt transportation.

The key to success of this operating plan is cooperation between the fishery and water management entities. Timely migration information must be provided to the PUD's, BPA, and the Corps in order to enable early planning to fully utilize flexibilities of the Pacific Northwest power system. All the COFO agency members agree to cooperate with each other in this regard and also with the "Northwest Power Planning Council" that was established in April 1981 in accordance with the 1980 "Pacific Northwest Electric Power Planning and Conservation Act." This act and its legislative history emphasize the need "to protect, mitigate, and enhance anadromous fish affected by the development, operation, and management of the hydroelectric facilities of the Columbia River and its tributaries while assuring the Pacific Northwest an adequate, economical, and reliable power supply." To this end the Act requires that the Federal agencies responsible for managing, operating, or regulating hydroelectric facilities of the Columbia Basin exercise their responsibilities in a manner that provides equitable treatment for anadromous fish with the other purposes for which the system is operated. The fishery agencies, tribes, and operating agencies agree to support the intent of the Regional Power Act, Council, and the plan it adopts to the extent that it does not conflict with Indian treaty rights and other applicable legal authority.

This document provides a summary of principles, specific measures, and responsibilities needed to implement a protection plan for juvenile migrants in 1982.

I. PRINCIPLES AND GUIDELINES

The Columbia River anadromous fishery is a valuable resource of the Pacific Northwest which has broad public concern and government involvement. In view of the experiences in recent low runoff years, in which there was substantial competition for available water supplies, and until complete results of turbine screening, bypass, juvenile fish collection, and transport programs can be evaluated, it is essential to prepare advance plans to provide passage of migrating juvenile fish. Current and future fishery management objectives give first priority to escapement and natural production of salmon and steelhead above Bonneville Dam. Any fish passage plan implemented should therefore give priority to protection of these migrants.

Yearling salmon and steelhead trout migrate downstream from tributaries of the Columbia and Snake Rivers to the ocean during the spring freshet each year, usually between mid-April and mid-June; sub-yearling chinook move downstream in a rearing migration between mid-June and September.

In years with average or above average runoff, streamflow in excess of powerhouse turbine capacity is discharged over spillways at dams. This higher flow and spill helps to expedite the juveniles' migration through the reservoirs and past the dams and substantially improves survival. Total survival from headwater streams of the Snake River through successive main-stem hydroelectric projects to The Dalles Dam in years of average and above average runoff, and prior to the present barge and truck transport programs, appears to have ranged between 25 percent and 45 percent. 1/

During low-flow years, juvenile migrants are subject to even harsher conditions. Except where bypass facilities are provided, nearly all of the downstream migrating fish pass through the turbines at the powerhouses. There is also considerable delay in migration through reservoirs, subjecting juvenile salmonids to increased predation and residualism.

Adequate instream flows and passage at dams are a necessity whatever action plan is implemented to protect downstream migrants. Therefore, management of flows, spill, and powerhouse loading at mainstem Columbia and Snake River dams during the outmigration of juvenile fish will be provided to reduce mortalities. In the event of failure of present bypass systems, spill will be used as specified in the Detailed Fishery Operating Plan.

In view of the above, the following principles and guidelines represent basic policies and actions for carrying out fishery operations in 1982:

1/ Raymond and Sims, 1980

1. The Columbia River Fisheries Council (CRFC) flow and spill recommendations (Attachments 2 and 3) will serve as interim guidelines for the Implementation Procedure in 1982. The goal of the 1982 Implementation Procedure will be to provide the recommended CRFC optimum flows (Attachment 2) when smolts are migrating in the project areas within the limitations of the 1982 runoff conditions and reservoir operations. If the monthly forecasts predict that it will be impossible to provide the CRFC optimum flows, then operating agencies will utilize their authorities to shape loads and arrange power purchases to provide maximum fish passage survival. Whatever runoff conditions occur, every attempt will be made to shape the flows to provide the CRFC minimum flows or better (Attachment 3) while smolts are migrating in the project areas (see Detailed Fishery Operating Plan).

2. Turbines are screened and there are operational bypasses at Lower Granite and Little Goose Dams on the Snake River and McNary Dam on the Columbia River. As in previous years, it is anticipated that most fish collected at these dams will be transported. Spill will be needed only if there is a significant failure in the guidance or collection system. Criteria for spill, numbers transported vs. number collected will be outlined in the annual work plan developed for the smolt transportation program. It is anticipated that all operating units at Bonneville Dam second powerhouse and three units at the first powerhouse will be screened prior to the spring outmigration. The new fingerling bypass for the second powerhouse should be operational. The new fingerling bypass for the first powerhouse will not be operational: the ice and trash sluiceway will serve as an interim transportation channel for 1982. Sluiceways will be operated as bypases at The Dalles and Ice Harbor Dams. Specifics on operations and monitoring at Bonneville, The Dalles, and Ice Harbor Dams are contained in the Detailed Fishery Operating Plan.

3. At Corps of Engineers dams without adequate bypass systems there will be spill as specified in the Detailed Fishery Operating Plan.

4. Mid-Columbia PUD's will conduct studies and provide monitoring, spills and flows in accordance with provisions in the current FERC settlement agreement.

5. During periods of juvenile migration, project operators and fishery agencies will provide personnel and resources to monitor the concentration of smolts and the progress and success of measures employed to move juvenile fish past Columbia River and Snake River projects.

6. Agencies will conduct research within funding and staff capabilties to take advantage of data collection and operating conditions afforded by the Detailed Fishery Operating Plan. Such research will seek to improve efficiency and effectiveness of juvenile fish passage measures and to provide better means of evaluation of the timing of the migration and the benefits derived from the operation. Project titles of research funded by the NMFS, BPA, and the Corps for 1982 are presented in the Detailed Fishery Operating Plan,

7. Discussions will be held by the water management and fisheries agencies following the January water supply forecast to plan the flow and spill needs as recommended by the CRFC. Such discussions are part of the development of the Detailed Fishery Operating Plan.

8. Information will be made available in a timely manner for inclusion in the COFO Annual Report.

II. DETAILED FISHERY OPERATING PLAN

(To be developed after to February 1; in developing the Detailed Fishery Operating Plan, consideration will be given to the recommendations of the fishery agencies to the Power Planning Council.)

III. IMPLEMENTATION

Implementation of the 1982 Detailed Fishery Operating Plan requires the coordinated effort of all project participants as well as Federal, State, and Tribal fishery agencies. General coordination and management of the process will be accomplished by the Committee on Fishery Operations of the Columbia River Water Management Group. Agencies or entities represented on the Committee are:

A. Fishery Agencies

National Marine Fisheries Service
U.S. Fish and Wildlife Service
Oregon Department of Fish and Wildlife
Washington Department of Fisheries
Washington Department of Game
Idaho Department of Fish and Game
Columbia River Inter-Tribal Fish Commission
Shoshone-Bannock Tribes

B. Operating and Regulating Agencies

Army Corps of Engineers
Bonneville Power Administration
Bureau .of Reclamation
Grant County PUD
Chelan County PUD
Douglas County PUD
Idaho Power Company
Federal Energy Regulating Commission

C. Public and Private Utilities

Portland General Electric
Pacific Power and Light
Puget Sound Power & Light
Washington Water Power
Tacoma City Light
Seattle City Light

Monitoring and surveillance of the fish migration will be provided by the fisheries agencies, Treaty Tribes, mid-Columbia PUD's, and the Corps. Fishery agency and/or project monitoring personnel will be present during periods of special spill for fish. Information related to the migration of fish and passage operations at each dam will be relayed daily to the Reservoir Control Center on the Columbia Basin Teletype System. Indices of juvenile fish migration will be the basis for initiating augmented flows or spills at a particular project. Details of the program for monitoring are provided in the Detailed Fishery Operating Plan. Special regulation of flows for juvenile passage will be scheduled by the operating agencies in consultation with the the designated fisheries agency personnel. Special regulation of fish passage flows at mid-Columbia PUD projects will be conducted in accordance with the current FERC settlement agreement. The regulation of flows will proceed on a daily basis until the fish passage operation is terminated. A list of operating personnel that will be involved in the scheduling of this operation is included in the Detailed Fishery Operating Plan.

RESPONSIBILITIES OF FISHERY MANAGEMENT AGENCIES

1. Provide monitoring and surveillance throughout the migration period.

2. Provide status reports on the timing of the downstream migration, including pertinent marked fish release and recovery data, with weekly written reports estimating percentages of run past key projects.

3. Coordinate hatchery releases to the extent possible to insure they are protected by regulated fishery flows and spills.

4. Provide appraisal to the operating agencies of the amount of flexibility in fisheries operations which may affect energy production while maintaining acceptable conditions for migrants.

5. Advise COFO on or before February 15 of all proposed and scheduled studies or special operations designed to improve fish passage operations which may affect energy production. Coordinate unforeseen changes with the Corps and BPA.

6. Within five working days following the receipt of the March volume runoff forecast, the fishery agencies and Tribes, through the Columbia River Fisheries Council, will report to COFO their views on flow recommendations for each reach of the rivers, including spill and generation reduction recommendations, plus collection and transportation criteria. Recommendations may be modified during the seasonal migration as additional information becomes available on fish movement and water supply.

7. Assure that all viable methods and procedures to reduce mortality to migrants are utilized. In addition to spilling and generation reductions this would include such operations as collection and transportation of migrants, use of ice and trash sluicewaps and others.

8. Coordinate input to water management decisions through a designated fishery agency coordinator. Where possible provide 48 hour notice to operating agencies on special flow requests.

9. Provide summaries of special operations and research findings in a timely manner for the annual COFO report in December.

RESPONSIBILITIES OF THE ARMY CORPS OF ENGINEERS

1. Provide timely formulation of volume runoff forecasts in January, February, March, April, May, and June to enable the fisheries management agencies and Tribes and those in energy production and marketing as much lead time as possible to prepare for operations relative to the impending migration.

2. Evaluate and report to COFO on the flood control program with particular regard to reservoir operations to achieve the optimum and/or minimum fishery flow requirements during the period of juvenile migration.

3. In cooperation with the fishery agencies, provide monitoring, surveillance, and reporting as needed at Corps projects throughout the migration period.

4. Coordinate project operations with regard to releases and/or transport of hatchery stocks with the designated fishery agency -coordinator.

5. Coordinate project operations with the power and fishery entities to assure that operating flexibility is made available for both fish passage and energy production.

6. Inform COFO before February 15 of all proposed and/or scheduled studies or special operations which may negatively impact or otherwise constrain fish passage or energy production. Coordinate unforeseen changes in fish passage operation through the designated fishery agency coordinator.

7. Within five working days following availability of the March runoff forecast, the Corps will submit a report to COFO containing its views on storage, flows, spills, generation reductions, and collection and transportation criteria.

8. Remove debris from forebay areas at all projects prior to and during juvenile migration to reduce potential buildup on trash racks and resultant smolt mortality.

9. Inspect turbine intake trash racks and orifices and remove debris at all projects just prior to and during juvenile migration, to assure that they are free of debris.

10. Check, service, and repair mechanical equipment needed for collection and transportation program prior to and during juvenile migration to assure equipment is in good working order.

11. Provide spills and flows, as provided in the Detailed Fishery Operating Plan and in support of the FERC settlement agreement for the mid-Columbia.

12. Inspect traveling screens on regular basis as specified in the Detailed Operating Plan. If damaged, repair or replace.

RESPONSIBILITIES OF THE BONNEVILLE POWER ADMINISTRATION

1. Report to COFO updated load-resource studies during the February through June period to supplement the Corps volume inflow forecast for fish passage planning assistance.

2. Provide their estimate of water available for fish passage.

3. Make secondary energy available for Northwest utilities to purchase for fish spill replacement, recognizing preference for that purpose over secondary sales outside the region, while not jeopardizing fish in other river systems in the Pacific Northwest.

4. Utilize available load-resource flexibility to shape flow requirements, spill priorities, and plant generation to mimimize fish passage losses.

5. In the event of drought conditions, BPA will coordinate interchange transactions to save, for the region, any surplus energyproduced from fish passage flows in excess of regional power requirements.

6. Within five working days following receipt of the March runoff forecast, the BPA will report to COFO concerning its views on flows, spills, and generation reductions.

7. Adjust system generation to provide adequate water to meet fishery operations requirements as soon as possible, but no later than 48 hours after the request.

8. Schedule operations to assist in providing spills with concurrent generation reductions, and flows as specified in the Detailed Fishery Operating Plan and in support of the current FERC settlement agreement for the mid-Columbia.

9. Negotiate for the funding of necessary fishery coordinating personnel.

RESPONSIBILITIES OF THE BUREAU OF’RECLAMATION

1. Inform COFO before February 15 of all proposed and/or scheduled studies or special operations which may negatively impact or otherwise constrain energy production or fishery flows.

2. Within five working days following receipt of the March runoff forecast, the Bureau will report to COFO concerning its views on water availability as related to fishery flows.

3. Provide flows as specified in the Detailed Fishery Operating Plan and in support of the current FERC settlement agreement for the mid-Columbia.

RESPONSIBILITIES OF MID-COLUMBIA PUBLIC UTILITY DISTRICTS

1. Coordinate with their project participants well in advance to assure meeting fishery flow and spill requirements during periods of downstream migration as specified in the Detailed Fishery Operating Plan.

2. Utilize available load-research flexibility and system coordination mechanisms to shape flow requirements, spill priorities and plant generation to meet customer requirements, minimize power losses, and minimize fish passage losses in accordance with the Detailed Fishery Operating Plan.

3. Frequently update status reports on the timing and numbers of the downstream migrants and provide regular reports to COFO and provide fish data daily to the Reservoir Control Center through the Columbia Basin Teletype System.

4. Operate projects in accordance with provisions of the Detailed Fishery Operating Plan.

5. Within five working days following receipt of the March runoff forecast, the PUD's will report to COFO their views on storage, flows, spills, and generation reductions.

RESPONSIBILITIES OF THE COMMITTEE ON FISHERY OPERATIONS

1. CGFO will be the primary coordination mechanism for implementing the 1982 fisheries operation program.

2. The Committee will publish a preliminary Detailed Fishery Operating Plan for 1982 by March 15. The proposed plan will be submitted to the heads of the participating agencies for their consideration and support.

3. The Committee will attempt to resolve differences within these principles and guidelines. Any unresolved differences that may arise will be submitted to respective agency heads for further coordination and resolution as outlined in Section IV of this document.

4. By April 1 the Committee will issue the Detailed Fishery Operating Plan.

IV. RESOLUTION OF DIFFERENCES

Should any major differences arise during the process of implementing the 1982 fishery operation program that cannot be resolved within the Committee on Fishery Operations, these will be referred to respective agency or department heads for resolution. The agency heads will meet as necessary to provide guidance, resolve conflicts and to conduct other matters necessary to efficiently execute the 1982 fisheries operation program.

The Commander, North Pacific Division, Army Corps of Engineers, and the Regional Director, National Marine Fisheries Service, will cochair interagency meetings that may be arranged for purposes described above. The cochairmen will seek the views and endorsement of state government, Tribes, other commissions, councils, and the public at large in consideration of any conflicts of disputes. Key participants in directing plan implementation include the following:

Commander, North Pacific Division, Army Corps of Engineers
Regional Director, National Marine Fisheries Service
Administrator, Bonneville Power Administration
Regional Director, Bureau of Reclamation
Manager, Grant County Public Utility District
Manager, Chelan County PUblic Utility District
Manager, Douglas County PUblic Utility District
Director, Oregon Department of Fish and Wildlife
Director, Washington Department of Fisheries
Director, Washington Department of Game
Director, Idaho Department of Fish and Game
Regional Director, U.S. Fish and Wildlife Service
Chairman, Columbia River Inter-Tribal Fish Commission
Chairman, Shoshone-Bannock Tribal Council

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1978. Evaluation of fish protective facilities at Little Goose and Lower Granite Dams and review of mass transportation activities, 1977. Natl. Oceanic Atmos. Admin., Natl. Mar. Fish. Serv., Northwest Fish. Center, Seattle, Wash., Processed Rep. 60 p.

ATTACHMENT 1

Settlement Agreement between PUD's, fishery agencies, and FERC - 5 year program.

UNITED STATES OF AMERICA
FEDERAL ENERGY REGULATORY COMMISSION

Public Utility District No. 2 of Grant County, Washington,	)	Project No. 2114
Public Utility District No. 1 of Chelan County, Washington,	)	Project Nos. 943 and 2145
Public Utility District No. 1 of Dougias County, Washington,	)	Project No. 2149
and		
State of Washington, Department of Fisheries,	)	Docket No. E-9569
vs.	)	
Public Utility District No. 2 of Grant County, Washington.	)	

OFFER OF SETTLEMENT

UNDERSTANDINGS

1. On March 7, 1979, the Commission issued an order which provided for an investigation and a hearing regarding various petitions filed in these dockets seeking certain minimum flow releases and spills from Projects Nos. 2114, 943, 2145, and 2149.

2. During the week of October 22, 1979, the parties engaged in negotiations for the purpose of reaching a settlement with regard to the various issues raised in these petitions regarding the flow requirements, spill and project operations for the downstream migration of juvenile salmonids. This has been commonly referred to as the "spring migration" phase, and covers the period from approximately April 15 through June 15. As a result of these negotiations, the parties have reached the Agreement set forth below.

3. The Agreement reached and the approval of this Agreement by either the Commission or the Presiding Administrative Law Judge shall not constitute an approval of or a precedent regarding any principle or issue in this or any other proceeding.

AGREEMENT

1. A five-year study program shall be conducted by the Public Utility Districts to investigate the effect of the projects and their operation on the downstream migration of juvenile salmonids. the methods of improving protection of natural production of salmonids, and the methods of improving and increasing semi-natural and artificial production of salmonids from the Mid-Columbia River. The studies to be performed in 1980 and possible studies for subsequent years are set out in Appendix A. The obligation to conduct the tests is subject to the availability of suitable and adequate numbers of test fish to be provided by the fisheries agencies.

The studies to be conducted in years following 1980, the priority of studies in yielding data material to resolution of the *issues* before the Commission in this proceeding and their experimental design will be determined by a majority of the Studies Committee composed of three biologists representing the Public Utility Districts and three biologists' representing all other parties. If there is no agreement on either the studies to be conducted or their design, then a decision on these questions will be made by *a* biologist who shall be acceptable to a majority of the Studies Committee. This person shall be chosen according to the issue before the *Committee.* The Studies Committee's recommendations, including recommendations to perform studies requiring expenditures in excess of the annual budgets referred to below, shall be submitted in writing to the PUDs at least annually, and not later than November 15. The Studies Committee or its designee(s) may review bids for the performance of studies and make recommendations to the PUDs on award of those contracts.

The cost of studies will *be* shared by the PUDs in such proporation or amounts *as* they shall agree among themselves, and the costs of study design, implementation and analysis shall not exceed $500,000 annually (1979 dollars), unless authorized by the Public Utility Districts. The *cost* limitation of $500,000 does *not* include operation and maintenance costs or capital expenditures for production facilities. The Studies Committee may recommend studies pertaining to reasonable structural changes as may be necessary for the installation and testing of prototype bypass systems, but may not recommend such installation for at least two years. The PUDs will consider recommendations by the Studies Committee for studies requiring expenditures in excess of $500,000 per year, and will authorize those studies that are likely to yield data material to resolution of the issues before the Commission in this proceeding and if prudent budgetary constraints permit. All parties to the proceeding, including staff, will be given a reasonable opportunity each year to review and comment upon specific study plans prior to their implementation.

The PUDs' agreement to study and test prototype by-pass systems does not constitute agreement that such by-pass systems are an appropriate long-term solution for protection of the fishery resource on the Mid-Columbia River.

2. As long as operation of the upstream federal projects and reservoirs does not prevent it, the daily average minimum flows to be maintained at each dam during the term of the studies shall be those determined in accordance with the following schedule.

	Apr. 1 Apr. 15	Apr. 16 Apr. 25	Apr. 26 Apr. 30	May 1 May 31	June 1 June 15
Wells	50,000	60,000	100,000	115,000	110,000
Rock Reach	50,000	60,000	100,000	115,000	110,000
Rock Island	60,000	60,000	110,000	130,000	110,000
Wanapum	60,000	60,000	110,000	130,000	110,000
Priest Rapids	60,000.	60,000	110,000	130,000	110,000

3. Spill.

A. Period. The period for spill provided herein at each of the dams will begin on the following dates, and will continue for 30 days or until approximately 80% of the migrating juveniles have passed the dams, whichever is sooner. When 80% of the migrating juveniles has passed the dam will be determined by a majority of the Designated Representatives or, in the absence of a majority within a reasonable time, by the Studies Coordinator:

Project	Date
Wells	April 15
Rocky Reach	April 25
Rock Island	April 25
Wanapum	May 1
Priest Rapids	May 1

The date of commencement of the spill at each dam is subject to modification upon agreement by a Designated Representative of the Washington Departments of Fisheries and Game, of the National Marine Fisheries Service, and of the Public Utility District responsible for operation of the dam.

B. Amount. The amount of water to be made available for spill shall not exceed on an annual basis the amounts determined for each dam by reference to Appendix B, *lines 1* and 2.

C. Rock Island. When the main units of the first powerhouse are not in operation, the amount of water available for spill at Rock Island dam shall be reduced proportionately *to the* amount of *reduction in* dam-related mortality *(as* discussed below) from the Rock Island bulb turbines as compared with Kaplan turbines in use at projects in the Coiumbia River basin. The basis for comparison shall be the bulb turbine mortality test conducted at Rock Island during 1979 and any previously published turbine mortality data for projects in the Columbia River basin. The comparative review of test data will be accomplished by an Ad Hoc committee composed of two representatives of the fishery agencies (Charles Junge, Wesley Ebel), two representatives of the Public Utility Districts (Dan McKenzie, Donald Ciiapman), *and* one independent representative (Douglas Chapman). The Ad Hoc Committee shall review the reliability of the results of the tests, and shall use such results as are found to be reliable by a majority of the Committee. As determined by a majority of the Ad iioc Committee, the amount of water to be made available for spill in connection with operation of the second powerhouse shall be calculated by multiplying, the ratio of all mortalities at Rock Island that are affected by spill to all mortalities at other dams in the Columbia River basin that are affected by spill by the amount of water otherwise determined *to* be available in accordance with Paragraph 3B. If the majority of the Ad Hoc Committee determines that a mortality,. such as forebay or tailrace mortality, is affected by spill but was not measured in the Rock Island Test or the tests conducted at other dams in the Columbia River Basin, then a majority of the Ad Hoc Committee shall rely on its best estimate of that mortality in calculating the foregoing ratio. Use of the mortality data from other dams does *not* imply its reliability or acceptance for any other purpose.

During the period when one or more of the main units of the first powerhouse is in operation, spill shall be accomplished from Gate 1 (at a daily average rate of 2000 cfs during the period of spill and an instantaneous minimum flow of 1000 cfs) in accordance with Paragraph 3.D. The amount of water to *be* made available *for* spill *in* connection with operation of the first powerhouse shall be in addition to the amount of water made available for spill in connection with operation of the second powerhouse, provided that the total amount of spill shall not exceed that determined in accordance with Paragraph 3.B. This assumes that the first powerhouse will be used for peak load generation. In the event that its use is shifted from peak to base load generation, then a majority of the Ad Hoc Committee may make appropriate adjustments to the amount of spill to be made from Rock Island dam, up to the amounts otherwise provided for in Appendix B. If an emergency condition exists: the decision shall be made by the Designated Representatives or, in the absence of a majority within a reasonable period of time, by the Studies Coordinator.

D. Use of Spill. Water shall be spilled up to the amounts determined in accordance with Paraeraah 3.B. and 3.C. above, as it is required to effectively move fish safely past the dams. The amount, timing of commencement and duration of spill required to move fish when they are present will be determined on a continuing basis by a majority of the Designated Representatives. If a majority of the Designated Representatives cannot be contacted within a reasonable amount of time, the decisions to begin and terminate spill, and the decision on the amount of spiil to be accomplished will be made by the Studies Coordinator, as described below at Paragraph 5, or by his designee, at each dam. Unless a greater amount of spill is authorized as described below, the amount of spill available daily will be limited to 10% of the'daily average flow. During the period of peak migration and on written notice of not less than three working days to the Licensee by a majority of the Designated Representatives (or by the Studies Coordinator when a majority of the Designated Representatives cannot be contacted, for their approval within a reasonable time), the amount of spill may be increased to not more than 20% of the daily average flow. Consistent with project design, spiil may be directed by the Designated Representatives (or the Studies Coordinator, when a majority of the Designated Representatives cannot be contacted for their approval within a reasonable period of time) to be made from surface spill facilities.

E. Supplemental Spill If at the conclusion of the 30-day spill period provided for in Paragraph 3.A 80% of the run has not passed a dam, then supplemental spill shall be available a: that dam. The amount of supplemental spill shall be determined by the election of either (a) until 80% of the run has passed the dam, the previously unspilled portion of water provided in Paragraphs 3.B and 3.C, or (b) for a period of 15 days or until 80% of the run has passed, whichever is sooner, an amount of water determined in accordance with Appendix B, line 3. If the Designated Representatives elect option (b) for use at Rock Island Dam, then the amount of water to be made available shall be determined by applying the ratio calculated under Paragraph 3.C to the water volume determined by use of Appendix B, line 3. Use of the supplemental spill shall be in accordance with Paragraph 3.D. If 80% of the migrating juveniles have not passed the dam, and the water provided for in Paragraphs 3.B. and 3.C. has been exhausted by the end of the 30-day period, then the Designated Representatives shall elect option (b). The determination of whether 80% have passed the dam and any election of supplemental spill shall be made not later than the end of the 30-day period provided for in Paragraph 3.A. by a majority of the Designated Representatives or, if a majority is not available within 2 reasonable period of time, by the Studies Coordinator. This determination and election shall be communicated to the PUDs by written notice and shall include a brief statement of the facts relied upon in making the determination.

4. Hatchery Production. During the term of the studies, the Public Utility Districts shall make available the following hatchery production capacity. During the term of the studies, each PUD shall bear the operation and maintenance expenses associated with the operation at its own facility subject to the reallocation of such expenses among the PUDs by their agreement. Expenses of the fisheries agencies in operation and maintenance which are attributable to the PUDs under this Agreement shall be subject to audit by the PUDs.

Wells Hatchery: 25,000 pounds of capacity for steelhead trout, or equivalent loading of other species.

Turtle Rock/Rocky Reach Annex: 75,000 pounds of capacity for fall chinook salmon, or equivalent loading of other races.

Priest Rapids: In addition to the foregoing, three sections of the Priest Rapids spawning channel shall be converted to rearing facilities according to the plan set forth in the CH2M Hill Mid-Columbia Production Optimization Study. The approximate capacity of this facility when completed shall be 75,000 pounds of fall chinook salmon or equivalent loading of other races. Except as provided below with respect to "Other facilities," and except in accordance with Paragraph 9, this shall be Grant PUD's sole obligation to provide hatchery production or rearing facilities during the 5-year term of this Agreement. Utilization of the Pries: Rapids spawning channel also may be subject to any orders entered by the FERC in licensing of additional units for Project No. 2114.

Other facilities: up to four additional sections of the Priest Rapids spawning channel shall be mad2 available for rearing facilities, developed with reuse of the water from the first three sections of the spawning channel. Tnese sections will be available, at the election of the PUDs, to provide 25,000 additional pounds of capacity for fall chinook or equivalent loading of other races. It also will be available, at the PUDs election, to make up any capacity deficit (as discussed below) for Wells, Turtle Rock/Rocky Reach or Priest Rapids as those are described above.

In the alternative, to obtain this additional capacity, the PUDs may elect to utilize any existing unused hatchery/rearing capacity in the Columbia River basin. If such election is made, the fisheries agencies agree to make such unused capacity available for the PUDs use, the reasonable opsrating and maintenance expenses of which production shall be borne by the PUDs. In the event that the additional four sections of the Priest Rapids spawning channel are not capable of producing the additional 25,000 pounds of capacity and/or making up the capacity deficit for Wells, Turtle Rack/ Rocky Reach or Priest Rapids, then it shall be produced in any unused capacity available in the Columbia River basin.

The determination of the species to be produced shall be the decision of the state, tribal and federal fishery agencies following consultation with the PUDs and the FERC Staff.

The production of 200,000 additional pounds as noted above shall neither impair nor reduce *the* effectiveness of the existing hatchery production commitments of the PUDs. The means for achieving these production increases shall be reviewed in advance by the state, tribal and federal fishery agencies, and annually thereafter. In the event that the loading rate estimates for Wells or Turtle Rock/Rocky Reach hatcheries or the first three sections of the Priest Rapids spawning channel are in error, and it is not physically possible to maintain, with application of the best operation and maintenance practices to optimize production levels, the production capacities defined above and produce healthy fish suitable for release, then additional capacity shall be provided by the PUDs according to the elections stated above. The loading rates used in this evaluation shall not be less than those now used in hatcheries/ rearing facilities operated by federal and state fisheries agencies under similar conditions.

Grant PUD shall use its best efforts to complete the improvement of the *spawning* channel at Priest Rapids for the 1980 brood year; provided, however, that if sufficient numbers of eggs are not available from the fisheries agencies improvecents of the spawning channel need be made only to the extent that eggs are available for production. For this purpose, the fisheries agencies will advise Grant PUD as to egg availability by November 1, 1980, and on each November 1 thereafter for that brood year.

5. Subject to the approval of a majority of the Studies Committee, the Public Utility Districts will designate a Studies Coordinator to coordinate the studies to be conducted in accordance with Appendix A. The Studies Coordinator shall coordinate the preparation of reports of the studies conducted.

6. The agencies of the State of Washington which are parties to this proceeding shall provide such permits and authorizations as are required to perform the studies described in Appendix A. The agencies also shall support the Public Utility Districts in obtaining such permits and authorizations as are required from other state and federal agencies to perform those studies.

7. The Public Utility Districts shall use their best efforts to publish a draft report of each year's studies, as described in Appendix A, by October 1 of the year following each *migration season.* Reports of any field *study* conducted pursuant to this Agreement by any of the parties to these proceedings with respect to the spring migration in the Mid-Columbia shall be made available upon request to the other parties and staff for review'and comment before'publication o: general circulation. Comments to any draft *report* shall be provided by all parties (and the FERC Staff) not later than 60 days following publication of the draft report. A final report shall be prepared within 90 days of the close of the comment period. Comments submitted shall be accepted in the report, or incorporated as an appendix to the report. All reports shall be filed with the Federal Energy Regulatory Commission.

6. All parties shall have full access to all data generated by, and in, the course of the studies. Subject to the control and supervision of the Studies Coordinator, all equipment used in the course of the studies shall be subject to inspection and observation by authorized representatives of any of the parties.

9. The Hearing scheduled for January 28, 1980, shall be cancelled. At any time after the completion of the first year of study and the availability of any report of study results, any two parties to this proceeding (including the FERC staff) may, on thirty days' written notice to the other parties, convene a settlement conference for the purpose of seeking, on the basis of the available study results and reports, modifications to the minimum flow or spill requirements described above, provided that a majority of the Studies Committee has recommended it.

Additionally, at the end of three years of study, any two parties may request, upon notice as provided herein, further hatchery production for the remainder of the study term, provided that the incremental mortality (as measured above natural mortality) attributable to the Mid-Columbia River dam system (as measured from the confluence of the Okanogan to the head of McNary pool) is determined, on the basis of data considered by the Studies Committee to have a high level of reliability, to be greater than 62%. The comparison of 62% shall be to the average of the mean mortalities determined from the studies. The natural mortality rate for the Mid-Columbia (as calculated on a per-mile basis) shall be based on the mortality measured in the Hanford reach from the area below Priest Rapids Dam to the head of the McNary pool. For the purpose of this paragraph the system and natural mortality levels shall be determined from at least two years of system mortality studies which are designed to achieve a high degree or reliability, and for which sufficient numbers of test fish are made available by the fisheries agencies. The system mortality tests shall not be conducted during periods in which the flows are substantially greater or less than the flows specified in Paragraph 2.

Additionally,, at the end of two years of study, any two parties may request, upon notice as provided herein, such reasonable structural modifications as may be necessary for the installation of prototype by-pass systems at one or more dams, provided that a majority of the Studies Committee has. recommended it.

In the event that any two parties believe that the PUDs have unreasonably rejected a recommendation of the Studies Committee to perform studies requiring expenditures in excess of $500,000, they may request a settlement conference.

The notice required by this Paragraph shall include a specific statement of the change requested to the Settlement Agreement and shall briefly describe the reasons for the change. Within ten days after receipt of said notice, any other party may give similar notice as to other changes which should be considered. In the event that the settlement conference is unable to reach a resolution, any two parties may petition the Administrative Law Judge or Commission to modify the requirements of this Agreement on the basis of the available study results and reports developed from the study program provided for by Paragraph 1.

The use of 62% system mortality as the basis for modifying this Agreement is not intended to be a standard for determining ultimate mitigation levels at the conclusion of the study period; nor does it imply that 200,000 pounds of hatchery production constitutes adequate mitigation if system mortality is less than 62%. Neither does this Agreement to provide hatchery production constitute any admission by the PUDs that any mitigation in addition to that now specified in the PUDs' licenses is required of the PUDs, or that the issue of mitigation is before the Commission in this proceeding.

10. On the completion of the term of study provided for by this Agreement, or by the Agreement as it may be amended, any party may petition the Presiding Administrative Law Judge or the Commission for the issuance of *an* order establishing further procedural dates in this portion of the proceeding.

STUDIES

The following studies will be undertaken in 1980 by the Public Utility Districts. Methods and specific objectives will be developed with open exchange of ideas and information between PUD and agency personnel. Timing and emphasis of post-1980 studies will depend on the recommendations of the Studies Committee and upon results of the 1980 studies.

The constraints on testing and studies include the following:

1. Gravity is to be used as much as 'possible in bypassing or transporting fish.

2. Hatchery fish to be used in studies which require active movement will be used when smolting and ATPase levels appear acceptable.

3. Insofar as possible, hatchery fish to be marked should be marked at least three weeks in advance of use in tests.

Studies in 1980:

A. Increased Production:

1. ATPase and smolt condition monitoring.
2. Acceleration of spawning (including hormonal and photo period alteration).
3. Preliminary hatchery siting, including literature review and site surveys on the Mid-Columbia River.

B. Survival Augmentation.

1. Evaluation of Rock Island bypass and study feasibility of collection.
2. Development of bypass systems using forebay skimming.
3. Airlift evaluation in gatewells at Rocky Reach (coordinated with John Day).

4. Review feasibility of transport and imprinting.

5. Monitoring of migrant distribution using gatewell dipping and hydroacoustic application.

C. Mortality Estimates

1. Wells turbine and spill studies shall have first priority in 1980.

2. Rocky Reach spill and turbine mortality.

3. System-wide and Hanford Reach mortalities.

4. If required and test fish are available, mortalities in connection with Wanapum sluiceway (unless this problem is alleviated through structural modifications at Wanapum).

Possible Studies After 1980 May Include the Following:

1. Continue migrant monitoring and implement hydroacoustics.

2. Mortality in skim spills.

3. Turbine and Project mortalities at Wanapum, Priest Rapids and first powerhouse Rock Island.

4. Continue studies of spawning acceleration.

5. Initiate transport pilot studies.

6. Effectiveness of split gates - Rock Island.

7. Evaluate collection and bypass at Rock Island.

8. Semi-natural rearing at Priest Rapids and Wells.

9. Annual evaluation of system-wide and Hanford Reach mortality.

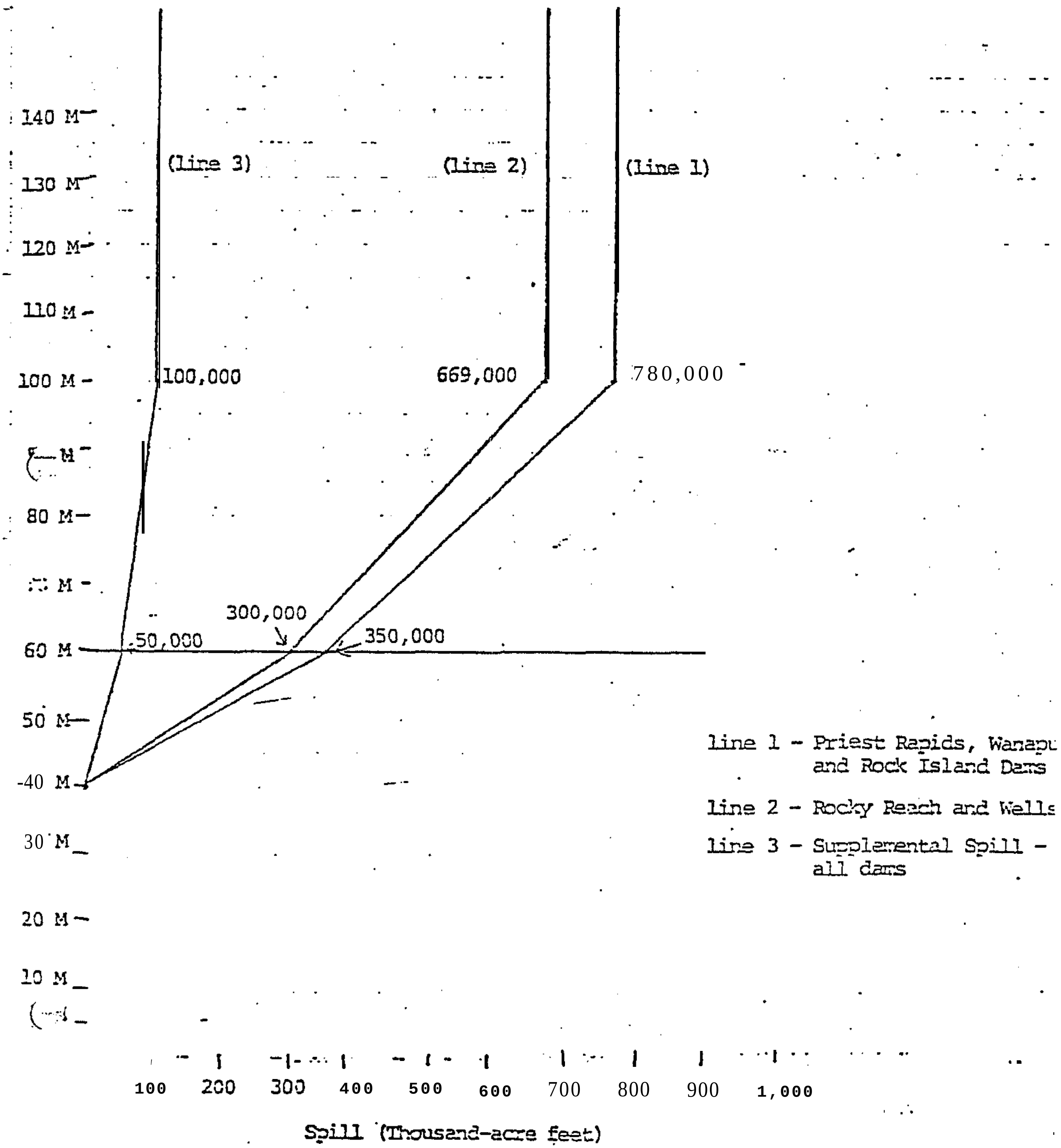
10. Habitat, seeding and rearing in tributaries.

11. Data evaluation, coordination and modeling.

12. Predation study leading to management-scale tests.

13. Preliminary hatchery siting,, including literature review and site surveys in non-Mid-Columbia areas, if Mid-Columbia River sites are not ava. - able.

APPENDIX B



140 M
130 M
120 M
110 M
100 M
80 M
60 M
50 M
-40 M
30 M
20 M
10 M
(line 3)
(line 2)
(line 1)
100,000
669,000
780,000
300,000
50,000
350,000
100
200
300
400
500
600
700
800
900
1,000
Spill (Thousand-acre feet)
line 1 - Priest Rapids, Wanapu
and Rock Island Dams
line 2 - Rocky Reach and Wells
line 3 - Supplemental Spill -
all dams

Attachment'2

CRF OPTIMUM FLOW RECOMMENDATIONS

Optimum Flow Recommendations

(1,000's cfs)

	Bonneville	McNa	Lower Snake	Priest R.
January	110	100	20	1/ 70
February	110	100	20	70
March	110	100	20	70
April				
1-15	190	180	100	70
16-25	225	215	110	100
26-30	250	245	120	120
May	300	290	140	140
June				
1-15	250	250	120	120
16-30	200	190	90	90
July				
1-15	Research required to define optimum flows during this period.			
15-31				
August				
September				
October				
November				
December	110	100	20	70

1/ Studies *ongoing to* determine critical flows for incubation and emergence of fall chinook.

Attachment' 3

CRFC MINIMUM FLOW AND SPILL RECOMMENDATIONS

Table 1. Provisional Recommendations for Instantaneous and Daily Average Minimum Flows at the Columbia River Forks, 1000's cfs

Month	Priest Rapids Inst	Priest Rapids Daily Average	Lower Snake Inst	Lower Snake Daily Average	McNary Inst	McNary Daily Average
January	70	70	10	20	20	60
February	70	70	10	20	20	60
March	70	70	10	20	20	60
April						
1-15	70	70	15	40	40	100
16-25	70	70	30	85	70	150
26-30	70	110	30	85	70	200
May						
1-31	60	130	30	85	70	220
June						
1-15	60	110	30	85	70	200
16-30	60	80	15	30	50	120
July						
1-15	60	80	15	30	50	120
16-31	60	110	10	20	50	140
August	60	95	10	20	50	120
September	36	40	10	20	40	60
October						
1-15	36	40	10	20	40	60
16-31	70	70	10	20	40	60
November	70	70	10	20	20	60
December	70	70	10	20	20	60

☐ During the period of spring juvenile migration, the equivalent of 20% of the average daily discharge at each project should be spilled except at those projects where there is adequate screening and/or other proven safe bypasses. At projects where spill is accompanied by requested sequential load dropping the spill requirements may be decreased. During the summer-fall juvenile migration (June 15-Nov. 30), the projects will be monitored and spill and sequential load dropping will be accomplished on a project by project basis to safely pass the juveniles.

Table 2. Provisional Recommendations for Instantaneous and Daily Average Minimum Flows at Lower Columbia River Dams, 1,000's cfs

Month	McNary Inst	McNary Daily Average	John Day Inst	John Day Daily Average	The Dalles Inst	The Dalles Daily Average	Bonneville Inst	Bonneville Daily Average
January	20	60	20	60	20	60	20	60
February	20	60	20	60	20	60	20	60
March	20	60	20	60	20	60	20	60
April								
1-15	40	100	40	100	70	120	70	120
16-25	70	150	70	150	70	160	130	170
26-30	70	200	70	200	70	200	130	200
May								
1-31	70	220	70	220	70	220	130	225
June								
1-15	70	200	70	200	70	200	130	210
16-30	50	120	50	120	50	120	70	120
July								
1-15	50	120	50	120	50	120	70	120
16-31	50	140	50	140	50	140	70	140
August	50	120	50	120	50	120	70	120
September	40	60	40	85	40	90	70	95
October	40	60	40	85	40	90	70	95
November	20	60	20	60	20	60	20	60
December	20	60	20	60	20	60	20	60

☐ During the period of spring juvenile migration, the equivalent of 20% of the average daily discharge at each project should be spilled except at those projects where there is adequate screening and/or other proven safe bypasses. At projects where spill is accompanied by requested sequential load dropping the spill requirements may be decreased. During the summer-fall juvenile migration (June 15-Nov 30), the projects will be monitored and spill and sequential load dropping will be accomplished on a project by project basis to safely pass the juveniles.

Table 3. Provisional Recommendations for Instantaneous and Daily Average Minimum Flows at Mid-Columbia River Dams, 1,000's cfs

Month	Chief Joseph Inst	Chief Joseph Daily Average	Wells Inst	Wells Daily Average	Rocky Reach Inst	Rocky Reach Daily Average	Rock Island Inst	Rock Island Daily Average	Wanapum Inst	Wanapum Daily Average	Priest Rapids Inst	Priest Rapids Daily Average
January	10	30	10	30	10	30	10	30	10	30	70	70
February	10	30	10	30	10	30	10	30	10	30	70	70
March	10	30	10	30	10	30	10	30	10	30	70	70
April												
1-15	20	50	20	50	20	50	20	60	20	60	70	70
16-25	20	60	30	60	30	60	30	60	30	60	70	70
26-30	20	90	60	100	60	100	60	110	60	110	70	110
May	20	100	60	115	60	115	60	130	60	130	60	130
June												
1-15	20	80	60	110	60	110	60	110	60	110	60	110
16-30	10	60	20	80	20	80	20	80	20	80	60	80
July												
1-15	10	60	20	80	20	80	20	80	20	80	60	80
16-31	10	90	60	100	60	100	60	110	60	110	60	110
August	10	85	60	90	60	90	60	95	60	95	60	95
September	10	40	20	40	20	40	20	40	20	40	36	40
October												
1-15	10	30	20	35	20	35	20	40	20	40	36	40
16-31	10	30	20	35	20	35	20	40	20	40	70	70
November	10	30	10	30	10	30	10	30	10	30	70	70
December	10	30	10	30	10	30	10	30	10	30	70	70

[Boxed rows: April 26-30 through June 1-15] During the period of spring juvenile migration, the equivalent of 20% of the average daily discharge at each project should be spilled except at those projects where there is adequate screening and/or other proven safe bypasses. At projects where spill is accompanied by requested sequential load dropping the spill requirements may be decreased. During the summer-fall juvenile migration (June 15-Nov. 30), the projects will be monitored and spill and sequential load dropping will be accomplished on a project by project basis to safely pass the juveniles. Chief Joseph Project should be fully loaded to prevent spill.

COLUMBIA RIVER INTER-TRIBAL FISH COMMISSION

8383 N.E. Sandy Blvd.
suite 320
Portland, Oregon 97220
Telephone (503) 257-0181

February 16, 1982

COMMITTEE ON FISHERY OPERATIONS

Dear Sirs,

The Columbia Inter-Tribal Fish Commission is pleased to have participated in the development of the Implementation Procedure for the 1982 Fishery Operation Program. Nevertheless, the Commission will not concur in approving the 1982 Implementation Procedure unless the following Inter-Tribal positions are reflected in that document.

1. The Inter-Tribal position is that only optimum flows are consistent with Indian treaty obligations. However, the Commission recognizes that 1982 will be a year of transition. Thus, the Commission will support a COFO position to the effect that optimum flows must be provided unless monthly forecasts predict that it will be impossible to provide optimum flows as developed by the Columbia River Fisheries Council. In such a case, operating agencies must shape loads and arrange power purchases to provide for maximum juvenile migrant survival. In any case, Columbia River Fisheries Council minimum flows must be provided while smolts are migrating in the project areas.

Consequently, the Columbia River Inter-Tribal Fish Commission does not support the language of paragraph number one on page five insofar as this paragraph states that, ". . .every attempt will be made to shape flows to provide CRFC minimum flows or better while smolts are migrating in the project areas." (Emphasis added.)

The Commission takes this position because the words "every attempt will be made" provide no ascertainable standard for compliance.

2. The Commission is concerned that the "current FERC settlement agreement" refers to the Settlement Agreement in existence at the time of adoption rather than at the time of flow implementation. Instead, the Implementation Procedure must provide that reference is made to the FERC
-4 Settlement Agreement current at the time the procedure is used. Further. the member tribes of the Commission, by concurrence in this document do not acknowledge its consistency with treaty rights.

3. Finally, the Commission believes that the draft Detailed Operating Plan must be available by March 15, 1982, and be finalized by April 1,

1982. Consequently, paragraphs two and four on page ten describing the responsibilities of the Committee on Fishery Operations should be changed accordingly. The Commission believes this change is necessary due to data which indicates that smolts are migrating in the project areas during the first week of April.

Sincerely,

S. Timothy Wapato
Acting Executive Director

RCL

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
ENVIRONMENTAL & TECHNICAL SERVICES DIVISION
847 NE 19th AVENUE, SUITE 350
PORTLAND, OREGON 97232
,503, 230-5400

March 23, 1982 F/NWR5:CHK

Memorandum

TO : Members of Committee on Fisheries Operations.

FROM : Charles H. Koski

C. H. Koski - Co-Chairman

SUBJECT: Detailed Fishery Operating Plan for Protection of Downstream Migrations of Juvenile Salmon and Steelhead in 1982.

Attached is the subject plan for your review and approval. Substantive comments should be presented in writing during the COFO meeting March 30, 1982.

Attachment 9 is not completed. It will be distributed at the COFO meeting,

The approved plan with attached comments will be forwarded to the Columbia River Water Management Group.

The plan will be implemented immediately upon approval.

DETAILED FISHERY OPERATING PLAN FOR PROTECTION OF DOWNSTREAM MIGRATIONS OF JUVENILE SALMON AND STEELHEAD IN 1982

March 30, 1982

II. Detailed Fishery Operating Plan-1982

This detailed Fishery Operating Plan (DFOP) sets forth the joint recommendations of the fishery agencies, tribes, and water management agencies for protection of downstream migrants by use of flows, spills, criteria for numbers of juvenile fish transported, spill with concurrent generation reduction at dams with partially completed or inadequate bypass systems, and monitoring activities at dams. In addition it discusses pertinant research operations at various projects and conditions affecting the probability of meeting the recommended flows and spill based on the March volume runoff forecast. The plan combines the best available data from a variety of sources into an operational framework for 1982. The Corps, BPA, and BR will utilize the plan in their joint interagency cooperative efforts established by the Water Management Group and Committee on Fishery Operations. The mid-Columbia PUDs are bound by current FERC settlements for the next three years and operations must conform to those specified therein. However, the other water management agencies are not constrained by the FERC requirements in their efforts to protect the fish resource. The DFOP is intended to be revised each year based upon changing needs for juvenile protection and seasonal rainfall and runoff patterns. The objective of this plan is to delineate the operations for protection of juvenile salmon and steelhead migrating in the spring and summer of 1982. The plan is intended to guide the Federal Columbia River Power System toward operation flexibility structured to meet the survival needs of anadromous fish. Attachments relating to this section are as follow: 1982 Work Plan for Transport Operations (Attachment 4), Research and Studies Funded by BPA, PUDs, and CE [Attachment 5), Agency Representatives and Contacts (Attachment 6), March Volume Forecast (Attachment 7), Fishery agencies and tribes letters to CE, BPA, BR, and FERC with responses (Attachment 8). and recommendations of the fisheries agencies for Basic Operating Standards for Downstream Migrant Passage Facilities (Attachment 9).

A. Flows

1. Spring Juvenile Outmigration Period

The spring juvenile outmigration period is generally designated as occurring between April 1 and June 15 of each year. During this critical period in 1982, every effort will be made to provide the CRFC optimum flow recommendations (attachment 2). When runoff forecasts show that it will be impossible to provide optimal flows throughout this period water and power management agencies will operate the Columbia River Power System to provide flows for maximum survival of juveniles and minimize adverse impacts on other uses of the water resource during the peak outmigration period. This generally occurs during a 30-50 day range within the April 1 to June 15 period.

Provision for flows in the range between minimum daily average and optimum daily average flows will minimize flow related mortalities to smolts resulting from delay and predation in reservoirs. In addition the agencies through the Columbia River Fisheries Council will consider a variance of the requirement for providing flow on a daily average basis and may allow flows on a weekly average basis during 1982 after receipt of such a request in writing from BPA. The CRFC optimum flows can usually be provided in the Columbia River whenever there is an average runoff year (January-July runoff at The Dalles = 109.6 MAF) without jeopardizing reservoir refill. Similarly, the CRFC minimum flows can usually be met in the Columbia River whenever the runoff forecast is 82% of average or 90 MAF at The Dalles. If the forecast is less than 90 MAF, flows may be met by modifying the existing storage reservoir operations, except in the Snake River, during extreme drought years. Due to the need to provide flows beginning in April and the inability to accurately forecast precipitation, adjustments in reservoir operations must begin immediately.

The March 1, 1982 volume forecast for the January-July runoff at The Dalles is 126 MAF; this is 115% of normal. Runoff projected for the Snake River is 37.6 MAF, 119% of normal. Depending on the manner in which runoff occurs, it should be possible to provide optimum flows through most of the smolt migration in the Columbia River and for part of the migration in the Snake River. Efforts are being made by all parties to provide optimum flows for smolt migrations in 1982.

- o. A carefully coordinated program between fisheries agencies, tribes BPA, and CE to monitor the smolt migration and hatchery releases to ensure that the needed flows for fish are provided at the proper time. (Attachment 10 provides times of hatchery releases).

- o. BPA will make every effort to shape loads in order to provide needed fishery flows and generation reduction.

- o. The CE and BR will make every effort to operate reservoirs to provide timely releases of water to enhance smolt migration.

2. Summer Juvenile Outmigration Period.

The period between June 15th and September 1st is the time during which most of the subyearling chinook are moving downriver. This migration is characterized as a rearing migration that continues throughout the summer and may have one or more peaks. It is difficult to define but represents a significant proportion of the production and thus needs to be protected. Monitoring will continue at key dams throughout this period in order to define the characteristics of the migration. Every effort will be made to provide the recommended CRFC daily average minimum flows or greater throughout the system during this period. Criteria for bypass system operation and spill at dams without bypass systems is covered in another section of this document. Operating and regulating agencies must reexamine their river operation guidelines to provide maximum flexibility for fish.

B. Forced Spill

When flows exceed what is usable for hydropower purposes then the excess water must be spilled. Priority of spill should be in the following order in 1982 to maximize smolt passage and minimize dissolved gas supersaturation. These relative priorities will change as the season progresses, with the amount of spill at each project and even which units to be shut down is dependent on the current estimated location of the peak juvenile out-migratation, status of adult runs, the time of day, the total flow available and amount of excess spill required. power requirements, thermal plant outages, research requirements, etc.,

(1) Lower Monumental-------------up to 30,000 cfs
(2) John Day-------------------up to 80,000 cfs
(3) Lower Monumental------------up to 50,000 cfs
(4) Ice Harbor------------------up to 50,000 cfs
(5) Wells------------------------up to 30,000 cfs
(6) Rocky Reach-----------------up to 50,000 cfs
(7) Rock Island-----------------up to 50,000 cfs
(8) Wanapum---------------------up to 20,000 cfs
(9) Priest Rapids---------------up to 40,000 cfs
(10) Chief Joseph----------------up to 50,000 cfs
(11) Priest Rapids---------------up to 70,000 cfs
(12) Washington Water Power------up to 500 MW equivalent
(13) Grand Coulee---------------up to 100,000 cfs
(14) The Dalles ------------------ No Limit
(15) Lower Monumental------------No Limit
(16) Ice Harbor------------------No Limit
(17) Little Goose---------------No Limit
(18) Lower Granite---------------No Limit
(19) McNary --------------------- No Limit

C. Reservoir Operations

The fishery management agencies have requested certain operational changes in 1982, to maximize the survival of spring and summer juvenile migrants because of the predicted high runoff for the Snake River. These requests are based upon observed behavioral characteristics of smolts and the fishery agencies understanding that often these requests can be met if power and reservoir operations are modified. Therefore, the requirements of fish are being integrated with operations of reservoirs in 1982 so that a higher degree of flexibility can be designed into all operations to meet fish passage needs. The CE, BPA, and BR will reexamine their present reservoir rule curves for adjustments to provide as much water as possible for fish passage throughout the migration period. (Attachment 8)

D. Passage, Transport, and Monitoring Acitvities at Corps of Engineers Dams

Every effort will be made to protect both spring and summer migrating juvenile salmonids from losses in passing through turbine intakes at dams, For 1982 the recommended protective measures will consist of collection and transportation of smolts from Lower Granite, Little Goose, and McNary Dams; operation of ice and trash sluiceways. at Ice Harbor, The Dalles, and Bonneville Dams, and spill with concurrent generation reduction at Lower Monumental and John Day Dams and operation of the gatewell salvage system. Spill criteria, bypass operations, load densities for collection and transportation of smolts, as well as other activities at each project arc outlined below. Research activities should be conducted so as to not significantly impact salmonid migrants.

1. Collector Dams and Fish Transport.

Lower Granite, Little Goose, and McNary Dams--Lower Granite, Little Goose

Dams and McNary (except for one unit) will be fully screened. Since screening of turbines does offer protection to juveniles, these projects will be operated for the most efficient collection of smolts and spill will be avoided if possible. To assist in maximum collection efficiency, it is recommended that constant generation be maintained (24 hours per day) at these facilities. (See Attachment 4 for additional details on powerhouse operations.) All fish collected may not be transported. The fishery agencies are quite concerned that perhaps one of the reasons for poor returns of transported chinook salmon is overcrowding of chinook in raceways, barges, and trucks, which in turn might lead to additional loss through disease transmission, etc. Therefore, the Columbia Basin Fisheries Technical Committee (CBFTC) is restricting the numbers of fish to be transported or held in raceways. Excess fish will be released into the bypass outfall. Criteria for load densities developed by the Fish Transportation Oversight Team (FTOT) are found in Attachment 4.

The above assumes screens are operating efficiently at all collector dams and fish are passing through the bypass in good condition. Screens and fish will be periodically inspected by the FTOT and onsite biologists. If the collection system is not effectively passing fish prompt attention will be given to rectifying the problem. If the system cannot be restored promptly spill will be provided to bypass fish. Spilling for juvenile passage will be requested through the Corps Biologist or Smolt Coordinator. Such spill will be comparable to that employed at other dams to efficiently pass juvenile migrants. In general, spill in bays adjacent to the powerhouse and generate in units nearest the spillway in order to provide the best attraction flow-net for smolts. When river flows exceed powerhouse capacity, and the bypass system is functioning correctly, spill will follow criteria for efficient adult passage. Additional detail on criteria for bypass operations are contained in the Annual FTOT Work Plan (Attachment 4).

Indexing through the juvenile bypass systems will provide the information on juveniles migrating by each dam. Releases of marked fish above Lower Granite and McNary Dams will provide the means to determine: [a) magnitude of migrations at each dam, (b) efficiency of collection facilities at each dam, (c) timing of migrations, and (d) survival of smolts to the lower river,

2. Juvenile Bypass Facilites

<u>The Dalles</u>--No additional spill for fish will be required at The Dalles Dam provided the sluiceway is operated for passing smolts in accordance with the recommendations of the Oregon Department of Fish and Wildlife (ODFW). The ODFW Biologists will be on site monitoring both spring and summer migrations to ensure their safe passage and ensure that water is not being wasted by sluiceway operations during minimal smolt migration perids. Contact at The Dalles is Dave Nichols.

<u>Bonneville</u>--Three of the 10 units of the 1st powerhouse and all operating units in the 2nd powerhouse will be screened in 1982. The ice and trash sluiceway in the lst powerhouse, as well as the bypass, will be operated which involves three screened units. The new fingerling bypass for the second powerhouse is scheduled to be operational, The CE is funding the NMFS to monitor smolt passage through the fingerling bypasses to ensure the systems are operating efficiently.

Ice Harbor Dam

Biosonics will be using hydroacoustics to evaluate the potential of using the sluiceway as a fingerling bypass. There will be four sluice gates automated so varying conditions of sluiceway operation can be tested. Three gates will be opened near the center of the powerhouse where most juveniles pass. The fourth gate will be at unit six next to the spillway. All turbine units, the sluiceway, and spillways 1, 2, and 3 will be equipped with transducers to provide indices of fingerling passage over the spill, through the sluiceway and through the turbines for varying conditions. Biologists from the Corps of Engineers and the fishery agencies will be on-site to monitor the various activities. If the on-site biologists determine that smolt passage through the sluice is ineffective, spill with generation reduction will be necessary to provide smolt passage at Ice Harbor Dam. When river flows and spill increase to the degree that nitrogen supersaturation becomes a problem, spill will follow adult spill criteria and there will be maximum generation through the powerhouse to minimize N_2.

3. Spill with Concurrent Generation Reduction

Spill has been demonstrated to effectively pass fish at a lower direct mortality than when fish are forced to go through turbines (Schoeneman et al. 1961; Sims and Ossiander 1981). It has also been demonstrated that at Priest Rapids Dam in 1980 the amount of fish bypassed in a spill situation is related to the amount of water spilled relative to total river flow (Carlson et al. 1980).

Lower Monumental and John Day Dams do not have effective fingerling bypass systems. Until efficient bypasses are provided, spill with concurrent generation reduction will be used 'for protection of juvenile migrants passing these dams. insofar as possible, changes in spill, and generation reduction should be presented to BPA scheduling by 10:00 a.m. on the day prior to the modification. Criteria for spill and generation reduction may change as the season progresses depending on behavior of smolts in the forebsy and information obtained from monitoring and research programs at each dam. Flexibility is the key. If, for example, smolts are concentrated immediately upstream of the dam just prior to dusk, as in 1977 and 1978, it would be necesssary to concentrate maximum spill with minimal turbine generation for about 2 hours. Conversely, if they are passing throughout the night with no buildup in the forebay as in 1980, then it would be necessary to extend the duration for spill until the migrants have passed the dam while reducing powerhouse generation as low as the BPA system will allow. Specifics in monitoring activities, research, and spill criteria follow.

Lower Monumental--Spill with concurrent generation reduction will be provided when significant numbers of smolts are present in order to protect nontransported smoits in the Snake River. Onsite biologists from the CE. and fishery agencies will monitor the smolt migrations. Indices used to determine presence of fish and effectiveness of spill will include sonar, visual observation, seagull activity, and timing of migrations at Little Goose Dam. The onsite CE biologist will be Dave Hurson. The onsite fishery agency biologist will be scheduled for each dam at a later date.

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Research in 1981 indicated that 32,000 cfs spill concentrated. in Bays 7 and 8 produced a significant surface current. There was also reduced generation. This procedure appeared to attract large numbers of juveniles away from the powerhouse and into the spill. A similar operation will be employed in 1982. (When there is spill for juvenile passage, the fishery entities request that there be at least as much water discharged over the spillway as there is being discharged through the powerhouse, i.e., 50% spill: that the spill be initiated when smolts are concentrated in the forebay and continue until smolts pass the dam; when river flows increase the amount of spill will be proportionately increased; as flows increase to levels where nitrogen supersaturation may become a problem, the spill pattern will be based on criteria for optimum adult passage. The Corps does not agree that 50% spill is needed; however, in 1982, in all probability 50% spill will be provided due to available water).

John Day Dam--This dam has inadequate fingerling protection and is presently causing unacceptable mortalities to both spring and summer migratory juvenile salmonids (CE Annual Report 1978, Sims 1981 and Park et al. 1980). It is anticipated that several million smolts will be passing John Day Dam even with turbine screening and transportation at McNary Dam. Therefore spill with concurrent generation reduction will be provided to protect spring and whenever possible summer migrants.

Spring Migration Operations at John Day--Spill criteria have been developed based on the most current available data. Research will be compatible with the planned protection program at John Day. Initiation of and the determination of when to cease spilling for the spring will be based on timing of the smolt migrations at John Day Dam as determined by (1) sonar monitoring (2) unit indecies (3) McNary indicator (4) the Dalles monitoring. Whenever spill is provided it will be initiated when juveniles are present and extend for up to 6 hours, depending on movement of smolts.

1. Provide project discharge a minimum of 140,000 cfs (160.000 cfs would be preferable) during periods of smolt passage at night.

2. Initiate spill when daily smolt passage exceeds 30,000 based on expanded Unit 3 index catches. Continue spill until migration has passed and number of smolts drops below 30,000. Based on the previous 3 years of sampling, 90% of the migration should pass in about 30 days starting sometime between 25 April and 4 May, and continuing until sometime between 27 May and 7 June. With an above average runoff predicted, changes are that the migration will be earlier and possibly more compressed than the last 3 years (see table below for timing 1979-1981). There may be an early peak in mid-April followed by several days when numbers drop below 30,000 fish. Spill can be terminated for the latter period if agreed to by the On-Site Biologists.

	1979	1980	1981
10-25%	5/01 - 5111	4/25 - 5/03	5/04 - 5/08
25-75%	5/12 - 5/27	5/04 - 5/20	5/09 - 5/30
75-90%	5/28 - 5/31	5/21 - 5/29	5/31 - 6/07

3. In view of the high expected runoff a minimum spill of 50% of project discharge will be provided starting at dusk and continuing until at least midnight. Spill beyond midnight would be dependent on Unit 3 hourly catches and sonar observations. Discharge in bays 15-20 should be maximized during periods of spill for juvenile fish passage.

4. Do not sequence turbine reduction prior to spill. Reduce powerhouse generation down to the same total flow as that being passed over the spill. Maintain sufficient generation in south shore units to minimize delay and predation to those smolts that tend to hang up in the south shore area; and distribute remaining generation across the powerhouse. (No amount of sequencing in 1981 moved any of this group of fish to the spill; it is better to provide attraction flow to pass them out of the forebay into the tailrace.)

5. When river flows exceed, 400,000 cfs, nitrogen supersaturation in the forebay of John Day Dam will be approaching 120%. At these levels, N_2 in The Dalles Dam forebay will increase to over 135% when spill is 50% or more for extended periods of 6 hours or more. At these levels, mortality of juveniles due to N_2 will be equal to John Day turbine mortality, (personal communication Wes Ebel). Therefore, whenever these conditions occur, increase generation through the powerhouse and distribute the. spill according to adult passage criteria to minimize N_2. The CE will have continuous reading saturometers in the forebays of John Day and The Dalles dams to monitor nitrogen levels in 1982.

6. Planned spill tests by CE have been cancelled for 1982 because of the high runoff forecast. There will be, smolt monitoring at the spillway and the powerhouse with improved hydroacoustics arrays over that employed in 1981.

E. Passage and Monitoring Activities at PUD Dams will be conducted in accord with terms of the Mid-Columbia FERC Settlement Agreement and with plans of the Mid-Columbia Studies Committee.

PUD and fishery agencies designated representatives will determine spill as outlined in the Settlement Agreement. Monitoring data and other data relative to smolt migration will be provided to. the smolt coordinator by the Mid-Columbia Studies Coordinator, Dick Whitney. Dick Whitney will be the central contact point for the Smolt Coordinator and others. The Studies Coordinator will transmit Mid-Columbia migration data to the smolt coordinator consistent with the agreed upon data collection procedure.

The amount of water available for spill is dictated by the FERC settlement agreement. For an average runoff or higher (January-July 109.6 million acre feet at the Dalles) the order allows up to 669,000 acre feet spill at Wells and Rocky Reach and 780,000 acre feet at Wanapum and Priest Rapids. Allocation of spill at Rock Island would be dependent on proportion of water through the new powerhouse according to the agreed upon formula.

The FERC settlement agreement also stipulates that the water allocated for spill is to be utilized to provide protection for the central 80% interval of the annual spring smolt migration. The occurrence of the EO% interval will be estimated at each PUD dam via the following model:

(1) An index of smolt passage will be generated at each PUD dam.

(2) The accumulation of index values will be plotted on a daily basis over time (see Figure 1)

(3) The 10% and 90% passage points will be estimated by inspection of the cumulative distribution functions for Wells, Rocky Reach, Rock Island and Wanapum Dams. These points are characterized by significant changes in slope. At Priest Rapids Dam where there are four years of prior indexing records, the definition of the 10% and 90% points will be estimated by inspection of the cumulative distribution function and empiricaly. The empirical estimate of the 10% point in the smolt migration requires a ten day indexing period. At Priest Rapids the date when the daily index equaled or exceeded twice the daily indicies averaged for the initial ten day indexing period has been a good estimator of the 10% point in the migration. Conversely, the 90% point in the migration is estimated as the date when the daily index fails below twice the daily indicies averaged for the initial ten day indexing period.

At each dam the allocated spill will be shaped to the migration with approximately 10% spill early and late in the migration and 15% or higher during the peak period during which 50% of the fish pass the dams. This shaping will be accomplished through analysis of the daily indexing data at each dam by the FERC settlement agreement designated representatives. The basic shaping method will be to match the slope of the cumulative smolt index function with a cumulative spill function (Figure 1).
Parties agree to meet on or near June 10 to discuss summer operations to protect juvenile chinook salmon.

1. Wells Dam

Contact Mike Erho, Douglas County P.U.D.

Monitoring activities were expanded in 1981 to provide tributary and forebay sampling in conjunction with hydroacoustic assessment in an effort to provide more reliable information on seasonal and diel timing, species composition, and relative abundance during the smolt migration. Data provided through the expanded smolt monitoring effort led to a refinement of fish spill procedures at Wells Dam resulting in improved coordination of spill volumes and fish abundance seasonally and timing of spill with diel passage of smolts at the project. hlonitoring activities in 1982 are designed to build on the data base developed in 1981 to increase the probability of matching spill to the smolt migration and in addition hydroacoustic assessment of relative passage through spillways and turbines will provide a measure of the success in meeting the goal of improved smolt passage.

Because of the unique design of the Wells tlydrocombine which incorporates turbines and spillways alternately in one concrete structure, spill and generation should be combined as much as possible in the same location laterally across the structure. Any reduction in powerhouse flows during fish spill operations should be accomplished in units away from where spill is occurring. Since spill occurs at a shallower depth than the turbine intakes, fish should be attracted to spillway flows in preference to turbine flows when provided the choice.

A special spill test will be conducted at Wells Dam on two separate occasions in 1982 to assess relative passage rate of smolts through spillway and powerhouse flows with as high a ratio of spill to powerhouse discharge as can be reasonably met (i.e. 75:25 or 80:20). During the remainder of the fish spill period, generation will naturally be reduced during peak periods of smolt passage (as determined in 1961) due to reduced nighttime loads.

Spill will generally be accomplished through automated spill gates 4, 5, 6, 7 or 8 as necessary to meet total volume goals and hourly spill schedules giving due consideration to structural limitations on the relationship of gate openings on adjacent spill gates. Spill and generation will be concentrated as much as possible at the automated spill gates and units at or adjacent to those spill gates during peak periods of smolt passage.

Provide 20 - 30 days of spill. Approximately 10% of the river flow would be spilled early and late in the migration and 15% spill during the peak (25 - 75% of fish passing). Exact time, percent and amount of spill would depend upon river flow and timing of smolt migration in 1982.

a. Criteria for 10% Spill - Deep spill 14,400 AF each day during periods of highest smolt movement, as determined from monitoring (hydroacoustics, fyke nets, tributary sampling and forebay purse seining and gull counts). Recommend spill: approximately 20,000 cfs for 8 hours or 40,000 cfs for 4.2 hours depending on monitoring data.

b. Criteria for 15% Spill - Deep spill until 25,400 AF is used each day. Suggest spill of 25,000 cfs for 12 hours each day of 50,000 cfs spill for 6 hours -- exact time and duration of spill would be determined from monitoring.

2. Rocky Reach Dam

Contact Steve Hays, Chelan County PUD.

Provide approximately 30 days of spill, depending on timing of smolt migration, in a pattern allowing the first approximately 10% of migration to pass prior to initiation of the spill. Spill for the next approximately 80% of the migration and no spill for the final approximate 10%.

This will not be rote-scheduled spill. Exact hours and days to spill will be based on timing of smolt migration as dcternined by onsite monitoring guided by historical records describing the spring migration timing curve.

Rocky Reach will use an intercepting, flushing type of spill of 30,000 cfs. The quantity of water spilled will be based on that rate multiplied by the number of hours necessary to pass the numbers of fish presenting themselves for interception type passage, as determined from monitoring stations located on each side of the spillway. The number of hours spilled may or may not be consecutive. The following example is presented as a guideline in calculating the amount of water used from the block of water allocated.

a. Up to 10% Spill--30.000 cfs for up to 8 hours = 20,000 AF maximum.

Exact hours of spill would be based on timing of smolt migration as determined by monitoring.

b. Up to 20% Spill--30,000 cfs for up to 16 hours = 40,000 AF maximum. Exact hours of spill would be based on timing of smolt migration.

3. Rock Island Dam

Contact **Steve** Hays. Chelan County PUD.

Similar spill to that proposed for other dams will be employed, i.e., approximately 10% spill early and late and up to 20% spill during the peak of the smolt migrations. Monitoring by sonar index, seagull index and smolt catches in second powerhouse fingerling bypass will be employed to determine amount of spill and optimum time to spill for smolts (day or night). Daytime spill will be correlated with suitable spill pattern for daytime adult passage.

Total reduction in spill at Rock Island from that proposed for other projects has been determined by the special Rock Island Statistical Committee as spelled out in the FERC order. The acre footage allotted for spill will be reduced by 21.1% for 1982 whenever spill is required and the old powerhouse is not operating. At times when both the new and old powerhouse are operating on base load generation, the 21.1% figure would be reduced in proportion to the amount of water passing through the old powerhouse. It is customary to pass most or all of the water through the more efficient, new powerhouse.

4. Priest Rapids - Wanapum Dams

Contact Mike Dell, Grant PUD

Similar spill to that proposed for other dams will be employed, i.e., approximately 10% spill early and late in the migration and up to 20% spill during the peak of smolt migration during the time when 50% of the fish. are passing the dam. Spring chinook yearlings make up the bulk of the mid-Columbia outmigration. Index counts used to determine when to spill at both Wanapum and Priest Rapids Dams in 1980 were the sum of all species passing Priest Rapids. Because of low sockeye counts, the index was low and spring chinook salmon were not afforded the best spill protection.

Washington Department of Fisheries, National Marine Fisheries Service, and Grant County PUD have agreed to implement an experimental cumulative smolt index monitoring program. Utilization of a cumulative smolt index will provide criteria for the initiation of spill at both Priest Rapids and Wanapum Dams and curtailment of spill based on protection of 80% of the run. Details on cumulative smolt index numbers which will govern the initiation and distribution of spill throughout the migration period will be developed by the above three agencies prior to the initiation of a spill program. In addition, a hydroacoustic monitoring index for Priest Rapids will be developed based on 1980 and 1981 data, and will assist in determination of the spill program for 1982. Gatewell dipping will occur at both Priest Rapids and Wanapum Dams to provide base data for smolt indexing purposes.

Criteria for Spill at Priest Rapids and Wanapum Dams--Reduction in powerhouse generation whenever there is spill at night will be a goal attempted by Grant PUD. There will be no skim spill at Priest Rapids Dam. There will be skim spill during the 12-hour nighttime period at Wanapum Dam. Deep spill will occur at both Priest Rapids and Wanapum Dams on spill gates which are hydroacoustically monitored. Selection of those spill gates will be determined prior to the spring migration.

Spill distribution throughout the migration period will be determined by a combination of cumulative smolt indexing and hydroacoustic monitoring. The precise distribution will be determined throughout the migration period by the designated representatives.

10% spill

Deep spill until 25,000 AF ate used each day. spill starting at dusk of 60,000 cfs for 5 hours or 40,000 cfs for 8 hours depending on smolt movement. Whenever possible reduce generation through the powerhouse during spill to a maximum of 75,000 cfs to maximize benefits of spill. Specifics on exact amount and time of generation reduction would have to be fully coordinated with BPA and WPR on a day to day basis.

15% to 20% Spill

Deep spill of 60,000 cfs for 8 to 10 hours starting at dusk. Generation through powerhouse same as above.

Criteria for Spill at Wanapum Dam

No generation reduction during spill. Skim spill will be employed 24 hours per day. Deep spill in bays adjacent to skim spill. The following criteria are suggested for each level of spill assuming 130,000 cfs daily average river flow.

10% Spill

Skim Spill 24 hr/day = 5,600 AF. Deep spill until 20,000 AF are used daily. Spill starting at dusk of 60,000 cfs for 4 hours or 40,000 cfs for 6 hours depending on smolt movement.

15% Spill

Skin spill 24 hr/day = 5,600 AF. Deep spill until 34,400 AF are used daily. Spill starting at dusk of 60,000 cfs for 7 hours or 40,000 cfs for 10 hours depending on smolt movement.

ATTACHMENT 4

ANNUAL WORK PLAN FOR TRANSPORT

OPERATIONS AT LOWER GRANITE, LITTLE GOOSE,

AND MCNARY DAMS, 1982

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ANNUAL WORK PLAN FOR TRANSPORT OPERAT-IONS

AT LOWER GRANITE, LITTLE GOOSE, AND MCNARY DAMS

AS DEVELOPED BY THE FISH TRANSPORTATION OVERSIGHT TEAM

FOR FIELD YEAR (FY) 1982

Cooperative Agreements will be provided between the State fishery agencies and the Walla Walla District, Corps of Engineers (NPW), with the Fish Transportation Oversight Team (FTOT) providing oversight of the program. This work plan is provided to describe operations and establish criteria for the transportation of juvenile migrants at the following collector dams: Lower Granite, Little Goose, and McNary.

The FY82 transport activities at Lower Granite, Little Goose, and McNary Dams are a continuation of the operational transport program established by the fishery agencies and NPW in 1981. This program will involve the fishery agencies providing biological oversight while NPI will be responsible for facilities management. Coordination among the council members and NPW will be through the FTOT composed of the NMFS Transportation Coordinator (Chairman and Program Manager), a NPW fishery biologist, and an Idaho Fish and Game fishery biologist. This document may be altered to reflect future conditions at the transport dams.

Objectives:

1. The collection and safe barge or truck transport of juvenile salmonids from collector dams to their subsequent release points below Bonneville Dam.

2. Training of NPW and State agency personnel associated with collection and transport facilities.

3. Coordinate the evaluation of the transportation program for the 1982 out-migration season.

4. Identify and recommend any changes which would be beneficial to the fish collection/transportation process.

5. Follow established Standard Operating Procedures (SOP's) for each collector dam as well as for the barges and trucks. SOP's will be updated to maintain current criteria for holding fish, i.e., fish densities, fish sampling, mortalities, and fingerling facility operation and maintenance.

6. Collector facilities will be ready for operation prior to the spring juvenile outmigration (April 1, 1982).

7. Inspections prior to, during and after the juvenile migration season will be conducted by FTOT. project and state biologists. These

inspections should insure facility readiness and operation at established criteria as well as determining maintenance requirements for the following season.

Project Operations for Smolt Protection

Maximum collection potential and condition of collected smolts is contingent upon timely and specific action by NPW. Some of the requirements for safe collection of smolts also apply to project operations at dams where collection and transport facilities are not used. It is expected that the Committee for Fishery Operations (COFO) will develop a Detailed Fishery Operations Plan (DFOP) for 1982. With this in mind, care must be exercised so that no conflicting requirements are imposed upon NPW in the transport program.

At the collector dams NPW has the responsibility for maintaining all equipment and providing safe passage for the migrating fingerlings through the dams via bypass systems, spillways or turbines. Procedures to meet these requirements are listed below:

I. Turbine Operations/Generation - To achieve maximum collection of juveniles in the best physical condition, it is recommended that a constant level of generation be maintained (24 hours per day) within the following ranges to achieve peak loading efficiency : 100 to 135 megawatts per unit at Lower Granite and Little Goose Dams, and 45 to 70 megawatts at McNary Dam. When fingerling counts reach 500 per day at a collector dam, the above loading ranges will go into effect. Past tests on traveling screens have shown that turbine operation in the ranges listed above should provide satisfactory collection of fish. If migrating salmonids do pass through a turbine, the peak efficiency range is a loading rate, as shown by Bell (1979), which will decrease direct turbine-related mortalities.

Normal turbine unit operation, as recommended by COFO in its 1981 Annual Report, is to run the units near peak efficiency to reduce fingerling mortalities. The 1982 schedule of priority unit operation at Lower Granite and Little Goose will be from unit 1 to 6. McNary Dam operating priority will be: units 4 through 10 and then 3, 11, 2, 12, 1, 13, 14. When additional generation is required above peak loading efficiency, the priority for transportation dams will be as follows: Lower Granite and Little Goose - add extra megawatts starting at unit 6 and move across the powerhouse to unit 1. McNary - reverse the order of operating priority as listed above. McNary Dam operates on load frequency control on the BPA grid. This turbine operation increases or decreases megawatts to each unit in equal increments. The powerhouse units would vary up or down according to power demands. When power demands arc low, operate units at priorities listed above.

II. Debris Problems & Trash Raking - Debris accumulation in the forebays of collector dams remains a problem. A trash boom above Lower Granite will be in place in 1982. NPW project resource personnel have removed much of the debris along shorelines of each pool, but high water will continue to bring debris to the dams from upriver areas. Therefore, an accumulation of debris is expected in front of the turbine units.

Trash racks will be raked at each dam prior to the juvenile outmigration season. Gatewells will be monitored daily for trash buildup and checked at

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least twice a week for water drawdown (head differential) between the forebay and gatewells. Head differential measurements at Lower Granite and Little Goose and McNary Dams will be recorded upon initial trash rack raking. Thereafter, when the head differential is greater than 1 foot over the initial measurement, trash racks will be raked again. This action will provide safer passage through the trash racks and into the gatewells.

The on-site biologists will coordinate with Project Engineers and FTOT to accomplish the raking at Snake River projects. If raking is required during fish runs, the unit being raked must be shut down. When the center rack (B) is being raked, it is not required to shut down adjacent units; however, when racks A or C are being raked, the adjacent unit will be shut down. At McNary Dam raking is accomplished by pushing debris down the trash racks. Units are not required to be shut down. This criteria will apply to McNary Dam until such time as a trash. crane is obtained.

III. Forebay Levels - At Lower Granite Dam, the forebay level should be maintained as close to 736.5 feet as possible during the juvenile migration season. Normal forebay levels are restricted to the following range in feet: 735-737.7. No forebay level restrictions are required at Little Goose and McNary Dams.

IV. Spills - At all collector dams there should be no spill unless flow exceeds powerhouse capacity or fish bypass systems fail. At collector dams, spill will be requested to enhance juvenile fish passage whenever the screens and bypass system are not providing safe passage and meeting criteria. This request will be coordinated by FTOT with the Smolt Coordinator who will request any spill with the power-producing entities. When river flows exceed powerhouse capacity and spill is required, FTOT recommends that any spill pattern should conform to already established spill for adult fish passage.

V. Fingerling Facilities/Bypass Operations - Gatewell orifices will de checked daily for flow volume and cleaned when necessary. The water level in the gallery will be checked daily and flows at the fingerling sorter need to be monitored continuously (at least hourly).

Once fingerlings enter the raceway system, the collection facility will be manned 24 hours a day until transport operations cease.

VI. Sampling Procedures - During the previous seasons all fish were counted via 3-1 inch counting tunnels at the collector facilities. The Little Goose distribution system was not modified so all fish will be counted as before. In 1982 only fish that are in the sample group will bc counted by the electronic counting tunnels at Lower Granite and McNary Dams. All estimated fish counts and raceway loading densities will be based on a sample of the total fish collected. The sample will be taken throughout a 24 hour day, i.e., 3-5 minutes per hour for the 24 hours and will bc based on a percent of the total daily collection which; will give a reliable statistical sample. Species composition is necessary to determine weight and loading factors in the individual raceways. This distribution system will require that project personnel keep a running hourly total of expanded fish numbers and raceway totals, FTOT recommends collected fish be spread among the raceways to prevent crowding even when densities are less than holding criteria.

VII. Facility and Equipment Logs and Records -

Log books - To monitor collection and transport activities the following items will be logged at each dam by either NPW personnel or state fishery biologists.

A. STS Activity - A daily log of STS operation should be maintained by the projects. Amp meter readings to monitor STS movement will be checked by shift and recorded once per day. All abnormalities will be noted.

B. Gatewells - Twice weekly recordings of head differential between the gatewells and forebay will be logged. When differentials reach established limits, trash raking will occur.

C. Fingerling Facilities - Daily logs will be maintained of fish countslhrlday by species, truck and barge operations, fish sampling, and general observations of fish condition and fingerling passage. Mortalities will be listed by species in all areas of the collection and transport system.

D. Trucks & Barges - Log daily activities for fish transport eouipment which will include transport time, problems encountered, e&mated fish mortalities if possible, and any equipment malfunctions.

VIII. Peak Migration Periods - When total collection at an individual project averages 20,000 smolts per day. Expected peak migration periods may vary at each dam. Past migration peaks at Snake River projects have generally occurred from April 15 to May 31. McNary peaks are variable. High priority must be placed on maintenance of screens, facilities, etc., during peak migration periods to provide maximum protection for smolts.

IX. Submersible Traveling Screens (STS) - STS's must be placed into operation at Lower Granite and McNary prior to the smolt outmigration (no later than April 1). Installation of screens at Little Goose Dam must-occur on or before collection reaches 500 smolts per day at Lower Granite Dam.

Smolt collections at transport dams have shown that certain units collect fish more efficiently. Units that show higher collecting efficiency are referred to as priority units, These priority units are: 1-4 at Lower Granite and Little Goose Dams; at McNary Dam, 4 to 10 are believed to be the best collector units.

The number and condition of fish collected are to a large degree dependent upon well-maintained screens. Quick repair of a damaged screen is important and must be accomplished, especially during peak migration periods. State and NPW personnel will monitor operational status of the traveling screens. FTOT and fishery biologists at each dam will be informed of any STS malfunctions. When a malfunctioning screen is noted, there are several options within flow limits that NPW can take: 1) abstain from generation in the affected unit until the screen is pulled for repair; 2) pull the STS and either repair or replace with a spare or other designated screen. A known damaged screen must never be used in a gcnernting unit. At Snake River collector dams, designated replacement screens are 6-C and 5-C. At McNary, designated replacement screens are in C slots of Units 14 and 13. A unit from which a designated replacement screen has been removed can be operated without a full complement of screens.

On weekends, when project maintenance crews are not available and a screen malfunctions, the following action is recommended: 1) the affected unit must be shut down and generation switched to a non-operating unit; 2) generation may exceed peak efficiency ranges established by FTOT in non-affected units if necessary; 3) spill water as necessary until the STS can be pulled and repaired or replaced with a spare or designated screen; 4) during peak migration periods or when a priority unit malfunctions, the malfunctioning screen must be replaced the same day.

Screen Inspection - A method for inspecting screens utilizing a video monitoring system was developed by NPW during the 1981 transport season. NPW is purchasing video monitoring systems at both the Snake River and McNary projects. With this technique in mind, FTOT recommends that the STS monitoring schedule at Snake River projects begin with an initial video inspection during the third week of April and again the third week of each month that the transportation season continues. The initial inspection date anticipates an outmigration peak which normally occurs during the final week of April or early May. At McNary Dam, traveling screens in priority units will be spot checked prior to the peak spring migration period (mid-late April). A spot check should include examining a traveling screen in the A or B slot of each priority turbine unit. Screens will be inspected again in June, between the spring and summer fish migration peaks. Unscheduled inspections may be required under the following conditions: 1) deterioration of fish condition; 2) increased debris load in bypass system; and 3) other indications of STS malfunction (erratic amp meter readings).

X. Loading Criteria - Beginning in 1982, collection of juveniles will be done without regard to size or species. 'This will be accomplished with wet separators at all projects. The following loading criteria will apply to all fish collected at the three transport dams.

A. Maximum raceway holding capacity is .5 lbs. of fish per gallon of water. Maximum inflow to raceways should be 1200 gpm at Snake River projects and 1000 gpm at McNary. Raceway volume is approximately 12,000 gallons of water at the Snake River dams and 7,400 gallons at McNary Dam. Exceeding holding criteria is not anticipated except during peak outmigration periods. During peak periods, a decision to exceed loading densities at Little Goose will be coordinated through FTOT. A decision will then be made to either exceed recommended densities, or bypass juveniles back to the river. Conditions that must be considered include: 1) species composition; 2) total anticipated collection during the critical holding period; 3) inriver bypass conditions; and 4) fish condition. It is expected that periods during which loading criteria are exceeded should be reduced by the addition of a fourth barge in 1982.

   At McNary Dam, loading criteria will be adhered to regardless of collection capabilities. When fish poundage in the raceways reaches the established limits (holding capacity), fish will be bypassed to the river.

At Lower Granite Dam, when the maximum raceway holding capacity is reached, fish will be bypassed to the river or passed directly into the barge to avoid overloaded conditions in the raceways. The majority of the fish diverted back to the river would be recaptured at Little Goose Dam for subsequent transportation. During low flow conditions criteria established for Little Goose Dam will be followed.

If a decision is made at the Little Goose project to temporarily exceed the holding criteria as listed in Section X-A, the increased raceway capacity may not exceed 1 lb. fish per gal. of water. In addition, a decision to exceed the recommended loading criteria should depend on the percentage of steelhead in the sample. Little Goose Dam may hold at the higher criteria during this time period only when steelhead composition in the raceway exceeds 80 percent of the total collected. This action should lessen the impact of overcrowding spring/summer chinook. Steelhead have demonstrated a higher tolerance to increased densities during the transportation process.

B. Current maximum inflow to the barge is 5200 gpm. Previous holding criteria of 5 lbs. of fish/gpm inflow totaled 26,000 lb. of fish as the holding capacity for a barge. With the barge volume being 85,000 gal. of water, the holding factor is 26,000 lb. fish divided by 85,000 gals. of water equals .3 lb. fish/gal. of water. Truck loading criteria is .5 lb. fish/gallon of water with a volume of 3500 gallons and a carrying capacity of 1750 pounds of fish.

XI. Summer Transport Program - The summer transport program at McNary (fall chinook) will operate under transport criteria established for the spring transport period. Transportation will continue at McNary until September 15 or until fish numbers arc 1000 or less for 5 consecutive days. Other factors as listed below for the Snake River projects may cause early termination of transporting fall chinook.

Due to the depressed condition of the Snake River fall chinook salmon, measures to increase their survival beyond the normal scope of the transportation program will be implemented as follows:

A. Transport will continue at Lower Granite and Little Goose until August 1 or until fish numbers approach 100 per day. Factors which could, cause earlier termination of truck transport include high fish mortalities encountered in the raceways as a result of high water temperatures, disease, or other factors causing mortality.

B. Truck loading density will be reduced to a minimum of 500 fish with a maximum 2 holding days in the raceways.

C. Fish will be counted so long as the collection and holding facility is in operation.

Transport Operations

1. Truck and barge operntions - A fourth barge will be on line this season which will allow a load 01 fish to leave Lower Granite daily. The barges require approximately 96 hours to make a round trip to the release site below

Bonneville Dam and return. Five fish hauling trailers 'are available with three leased tractors and two Corps-owned tractors. Release site for trucked fish is at Bonneville Second Powerhouse. Backup truck release sites are located at Bradford Island and Dalton Point. The barge unloads below Beacon Rock near the Skamania light buoy. As in the past, barges will have priority use of locks.

Truck drivers will undergo extensive training so that they are familiar with their truck life support systems for fish; have a good understanding of the sensitivity of juvenile salmonids to stress; know where and under what conditions fish must be released in an emergency.

At the beginning of the transport season all fish will be trucked from each dam. Barging will be implemented when the smolt count approaches 25,000 par day at Lower Granite. Barging should continue through the spring peak migration period until smolt numbers are reduced to 25,000.

Modifications of fish facilities will allow direct loading of fish into barges. To reduce raceway loading density and stress involved in the loading process, FTOT recommends as much direct barge loading of fish as possible.

Biological personnel will be on barges whenever fish are aboard and 'supervise all londing and off-loading operations. During the training period barge personnel will receive adequate instructions to deal with emergencies. If an emergency situation occurs while the barge is underway, the barge biologist (technician) is responsible for deciding if and where an early release will be made. Dissolved oxygen levels will be the deciding criteria. There will be radio contact between the barge and dams on the transportation route. Any major problems which may occur must be coordinated with, the project biologists.

State Roles

Fishery agencies are responsible for biological oversight of fish at transport dams. The NPW will provide funds to the states for stationing fish biologists or culturists at each collector facility. Idaho Department of Fish and Game, Oregon Department of Fish and Wildlife, and Washington Department of Fisheries will assign state personnel who will be present at the project throughout the duration of the transport season.

Cooperative agreements between the states and NPW will specify duties of state personnel as set forth in their task orders of the agreement. Tasks to be performed by the states include participation in all activities directly affecting the welfare of the fish. These activities include but are not limited to: 1) fish sampling and handling, 2) evaluations of fish condition, 3) double checks on expanded calculations of total facility collection, 4) quality assurance inspections of collection and transport facilities, and 5) monitoring group activities at dams including research.

Dissemination of Information

Fishery Biologists at each dam will be responsible for having all pertinent information on numbers collected, hauled, special problems, etc., to the project powerhouse operators before 4 p.m. each day. NPW opcrntors will place this information on the teletype which will then be available in Walla Walla and

Portland Districts, and North Pacific Division (NPD) office. In addition to the teletype, the Program Manager' of FTOT will coordinate special flow and spill requests with the Columbia River Fisheries Council Snolt Coordinator. CRFC will provide a weekly summary report of transport numbers from the collector dams to fishery agencies, Corps offices, BPA, etc.

NPW Project Requirements for Fishery Agency Activities

To develop a better working relationship and communication process at NPW projects, fishery agencies should follow certain courtesy and safety habits. They should include: 1) checking into the project properly, i.e., notifying the project biologist or engineer that you will be arriving or have arrived on site; 2) adherance to local project requirements (hard hats, safety procedures, etc.), 3) common courtesies, and 4) prior arrangements or notification of any unscheduled activities (research, etc) .

Due to increased security measures, it has become more difficult to gain access through NPW projects. The importance of checking into a project requires a special key after visiting hours, so the checking in procedure has become a necessity.

ATTACHMENT 5

COE, EPA, AND PUD PLANS

FOR RESEARCH AND STUDIES - 1982

Army Corps of Engineers Plan for Research

1982

A Summary of the various activities funded by the Corps and assoicated with anadromous fish research and studies is as follows:

1. Evaluation of Adult Fish Collection Facilities at Lover Columbia and Snake River Dams with Electronic Tunnels and Radio Tag Tracking Equipment

a. Determine adult salmonid entrance preferences and entry rates during various powerhouse operating conditions.

b. Determine whether there is adult fish delay or mortality associated with entry into the collection-passage system.

c. Modify, test and establish collection system conditions to improve adult salmonid collection and passage efficiency.

2. Pteliminarv Evaluation of Bonneville 2nd Powerhouse Adult Fish Collection and Passage Facilities

a. Determine injury rate for adult salmonids using the second powerhouse fish passage facilities.

b. Determine migration routes holding/milling areas and fish collection system entry locations.

c. Determine fish passage times to establish extent of pre-passage delay.

3. A Comprehensive Studv To Determine If The Excessive Adult Fish Passage Delays at John Day Dam are Associated vith Chemical Pollutants. The study will focus on:

a. The John Day River as a source of herbicides and pesticides.

b. The John Day Dam as a source of project-produced effluents.

c. A north-forebay aluminum plant'with an effluent outfall just upstream from the John Day Dam North fishladder.

4. Evaluation of Transport of Juvenile Salmonids and Evaluation of Adult Fish Returns from Juvenile Fish Transported in Previous Years

a. Evaluate returns of adult fish to Lower Granite Dam from fish marked as juveniles at Lower Granite, Little Goose and McNary Dams by recording of fish freeze branded, fin marked or wire tagged in previous years.

b. Evaluate returns of adult fish marked at Lover Granite, Little Goose and McNary Dams to Bonneville Dam, from sport, commercial and Indian fisheries and to hatcheries and spawning grounds.

c. Preliminary evaluation of transport stress on juvenile salmonids utilizing a salt water challenge technique.

5. Evaluate Lover Granite, Little Goose Modified Travelling Screens

a. Measure STS guiding efficiency with a standard and a balanced flow vertical barrier screen.

b. Measure gatewell orifice fish passage efficiency.

c. Determine stress levels for fish in gatevells with a standard and s balanced flow vertical barrier screen.

d. Measure STS guiding efficiency during reduced turbine loading.

6. Determine Operating. Criteria For Ice HarborDam Trash Sluicewav When Utilized As A Surface Skimming Collector By-pass System For Juvenile Salmonids

a. Determine the optimum sluice gate combination and sluiceway flow for juvenile fish passage.

b. Estimate the sluicevay efficiency for passing juvenile salmonids approaching the projects.

c. Estimate the proportion of juvenile fish passing through the turbines and spillway.

d. Estimate the special, temporal. and die1 distribution of spring outmigration.

7. Studies to Relate Riverflow and Juvenile Fish Survival For Protection of Non-Transported Juvenile Salmonids.

a. Define the effect of instream flows on the survival level of juvenile salmonid outmigrations in the Lower Snake and Columbia Rivers.

b. Obtain information on the magnitude and timing of the juvenile salmonid migrations at Lover Granite, McNary and John Day Dams.

8. An Evaluation of Juvenile Salmonid Behavior and Approach Characteristics In The Forebav During A Variety of Spill and Turbine Flow Conditions Using Juvenile Radio Tags

a. Determine the impact of project spill and powerhouse operations on the approach and passage behavior of juvenile spring chinook.

b. Correlate behavior of marked juvenile fisb to the John Day forebay flow nets.

9. Research Related To Development of A Juvenile Fish Collection and By-Pass System At John Day Dam

a. Evaluate submerged travelling screen guidance efficiency with balanced flow vertical barrier screen.

b. Evaluate gatevell orifice submergence.

c. Determine gatevell orifice FPE with balanced flow vertical barrier screen.

d. Evaluate STS cycling operations.

10. Sonar Monitoring of Juvenile Fish At John Day Dam Project

a. Monitorjuvenile fish passage patterns during special spill periods to determine best spill times, durations and volumes.

b. Quantify the numbers of juvenile fish passing John Day Dam.

11. Prototype Test Operations of Juvenile Fish Indexing System In The Trash Sluiceway At The Dalles Dam

a. Detemine numbers of juvenile fish passing through the sluiceway system compared to total passage through the dam.

b. Develop and calibrate the sluiceway juvenile fish indexing trap.

12. Post Construction Evaluation of New or Rehabilititated Juvenile Fish Collection and By-Pass Systems At Bonneville Dam 1st and 2nd Powerhouses (Preliminary monitoring only in 1982. Intensive testing in 1983.)

Fiscal Year 1982 Fish and Wildlife Program

Contracting Agency	Project No.	Title
NMFS	78-1	Imprinting of Hatchery-Reared Salmon and Steelhead Trout for Homing of Transported Fish
	* 79-1	Genetic Identification Study
	79-2	An Evaluation of the Contribution of Chinook Salmon Reared at the Columbia River Hatcheries to the Pacific Salmon Fisheries
	80-1	Coordination of Smolt Monitoring
	81-1	Effects of Flow on the Migratory Behavior and Survival of Fall and Summer Chinook Salmon in John Day Reservoir
	* 815-1	Coordinated Assemblage and Analysis of Anadromous Fishery Information and Data for Implementation of Section 4(h) of Pub. L. 96-501
	* 81S-2	Migrational Characteristics of Juvenile Salmonids in the Columbia River Estuary
	82-2	Use of a Fish Transportation Barge for Increasing Returns of Steelhead Trout Imprinted for Homing
	82-7	Snake River Fall Chinook Brood Program
	82-a	Smolt Passage Behavior and Flow Net Relationships in the Forebay of John Day Dam
WDG	81S-3	Coded-Wire Tag Sampling Shortfall
WDF	81S-3	Coded-Wire Tag Sampling Shortfall
PMFC	* 82-13	Coded-Wire Tag Sampling Shortfall
ODF&W	79-4	Study of Wild Spring Chinook in the John Day and River
	81S-3	Coded-Wire Tag Sampling Shortfall
	* 82-9	Habitat Improvement: John Day River
	* 82-12	Estimate Abundance and Growth Characteristics of Squawfish and Walleye in John Day Reservoir and Tailrace

contracting Agency	Project No.	Title
USFWS	* 82-3	Feeding Activity, Rate Consumption, Daily Ration and Prey Selection of Major Predators in the John Day Pool
	* 82-4	Development of an Effective Transport Media for Juvenile Chinook Salmon
	* 82-11	Bioenergctics of Juvenile Salmon During the Spring Outmigration
MDFWP	81S-5	Effects of Operation of Kerr and Hungry Horse Dan on Reproductive Success of Kokanee in the Flathead System
Nez Perce Tribe of Idaho	82-1	A Biological and Physical Inventory of the Streams Within the Nez Perce Reservation.
confederated Tribes of the Umatilla Indian Reservation	* 82-10	Study to Prepare a Coordinated Stratigic Plan for Restoration and Enhancement of Anadromous Salmonid Populations Within the Umatilla Reservation and Oregon Ceded Lands of the Confederated Tribes of the Umatilla Reservation
univ. of Idaho	* 82-5	Effects of Stress on the Viability of Chinook Salmon Smolts Transported From the Snake River to the Columbia River Estuary
OSU	* 82-6	Columbia River Salmonid Outmigration: McNary Dam Passage and Enhanced Smolt Quality
WSU	* 82-14	Development of New Concepts in Fish Ladder Design

* Projects are in contract negotiations, 3/18/82

VUraine:ts (WP-PBG-0275N)

Mid-Columbia PUD studies for 1982

Systems Mortality Study
- 4 release sites, 4 replicates
- recovery at McNary at 3% sampling
- 400,000 spring chinook

Rock Island 2nd Powerhouse Bypass Evaluation
- 9,000 steelhead, 9,000 coho, 12,000 steelhead
- will operate bypass trap to index migration

Rock Island Hydroacoustic Study 2nd powerhouse to determine vertical 7 horizontal distribution and trajectory

Rock Island 2nd powerhouse Hydraulic Model Study

Rocky Reach Hydraulic Model Study

Rocky Reach Forebay Floating trap

Rocky Reach Gatewell Dipping

Rocky Reach Hydroacoustic Study

- Powerhouse vertical and horizontal distribution and trajectory

Wells Dam Hydroacoustit Study

- Vertical distribution, trajectory and spill vs powerhouse passage

Okanagon tributary trap

Engineering Feasibility of Tributary Collection

Engineering Feasibility of Powerhouse Collection
- Wells fyke net in submerged gatewell to determine migrant passage

*- Spill Study at Wells and Priest Rapids

- Test spill utilization with maximum difference in Turbine Q vs Spillway Q

Wanapum Hydroacoustic Study

- Vertical & horizontal distribution trajectory

Priest Rapids Hydroacoustics

- Spillway & powerhouse

Priest Rapids Engineering Feasbility Study
- Bypass options for Priest Rapids

*- Homing Transportation Study with Wells Steelhead

* tenative

ATTACHMENT 6

AGENCY REPRESENTATIVES

AND POINTS OF CONTACT

AGENCY REPRESENTATIVES AND POINTS OF CONTACT

OPERATING AGENCIES

CORPS OF ENGINEERS: (CHIEF JOSEPH, DWORSHAK, LOWER GRANITE, LITTLE GOOSE, LOWER MONUMENTAL, ICE HARBOR, MCNARY, JOHN DAY, THE DALLES, AND BONNEVILLE DAMS)

GORDON GREEN	
CH. RESERVOIR CONTROL CENTER	(503) 221-3741 (FTS 423-3741)
HOME PHONE	(503) 645-1341
JIM FODREA	
CH. REGULATION UNIT	(503) 221-3741 (FTS 423-3741)
HOME PHONE	(503) 649-9841
JIM CAYANUS	
CH. SPECIAL PROJECTS UNIT	(503) 221-3741 (FTS 423-3741)
HOME PHONE	(503) 646-7773
ED MAINS	
CH. ENVIRONMENTAL RESOURCES BRANCH	(503) 221-3828 (FTS 423-3828)
HOME PHONE	(503) 644-6548
JOHN MCKERN	(509) 525-5340 (FTS 442-5340)
NPWPL BIOLOGIST	
JIM ATHERN	(509) 525-5625 (FTS 442-5625)
NPWOP BIOLOGIST	
DICK DUNCAN	(503) '221-6073 (FTS 423-6073)
NPPOP BIOLOGIST	
JOHN WILLIAMS	(503) 221-6402 (FTS) 423-6402)
NPPPL BIOLOGIST	

BONNEVILLE POWER ADMINISTRATION:

ROSS COMPLEX SWITCHBOARD FROM OREGON	(503) 283-3361
FROM WASHINGTON	(206) 696-0351
DICK HAINS	
HEAD, POWER SCHEDULING	EXT. 503 (FTS 422-1503)
ROGER SCHIEWE	EXT. 551 (FTS 422-1551)
ROGER HEARN	
HEAD OF HYDROMET	EXT. 500 (FTS 422-1500)
SCHEDULERS 0730-1640 WEEK DAYS	EXT. 556
ALL HOURS & DAYS	(FTS 422-1554, DATS 922-174)
1600-0730 & WEEKENDS	(503) 283-5082
	(206) 693-8086
GREG DRAIS	
FISHERY BIOLOGIST	(503) 230-4981

BUREAU OF RECLAMATION (GRAND COULEE DAM)

HAROLD BRUSH	(208) 384-1381 (FTS 554-1381)
JOE WENSMAN	(208) 384-1420 (FTS 554-1420)

DOUGLAS COUNTY PUD: (WELLS DAM)

BURRELL POPE CH. DISPATACHER	(509) 884-7191, EXT. 19
MIKE ERHO BIOLOGIST	(509) 884-7191

CHELAN COUNTY PUD: (ROCKY REACH & ROCK ISLAND

DICK NASON FISH & WILDLIFE SUPERVISOR	(509) 663-8121, EXT. 243
STEVE HAYS BIOLOGIST	(509) 663-8121
LEW SCHOENTRUP CH. DISPATCHER	(503) 663-8121, EXT 220

GRANT COUNTY PUD: (WANAPUM & PRIEST RAPIDS DAMS)

AL WRIGHT ENVIRONMENTAL SUPERVISOR	(509) 754-3541, EXT. 340
MIKE DELL BIOLOGIST	(509) 754-3541
BOB GRIBBLE DIR. OF SYSTEM OPERATIONS	(509) 754-3541, EXT. 212

IDAHO POWER COMPANY: (BROWNLEE, OXBOW & HELLS CANYON DAMS)

C.E. BISSELL VICE PRESIDENT	(208) 383-2421
P.K. "MICK" BARRON	(208) 383-2426

FISHERY AGENCIES

SHOLT COORDINATOR:

TERRY HOLUBETZ, CRFC	(503) 231-2241 (FTS 429-2241)
HOME PHONE	(503) 678-1468

CBFTC COORDINATOR

CHARLES KOSKI NMFS, PORTLAND	(503) 230-5405 (FTS 429-5405
HOME PHONE	(503) 324-3695

JUVENILE MIGRATION MONITORING COORDINATOR:

HOWARD RAYMOND NMFS SEATTLE	(206) 442-4445 (FTS 399-4445
HOME PHONE	(206) 365-4165
CARL SIMS NMFS SEATTLE	(206) 442-4445 (FTS 399-7640)
HOME PHONE	(206) 546-5398

FISH TRANSPORTATION OVERSIGHT TEAM:

LARRY BASHAM NMFS, PORTLAND	(503) 230-5411 (FTS 429-5411)
HOME PHONE	(509) 427-4177

COLUMBIA RIVER INTER-TRIBAL FISH COMMMISSION

CHIP MCCDNAHEY	(503) 257-0181

PUBLIC AND PRIVATE UTILITIES

PORTLAND GENERAL ELECTRIC

HERB MILLER	(503)226-8391
DON CLARK	(503) 226-8404

PACIFIC POWER & LIGHT CO:

ROY HAMILTON	(503) 243-4216
STAN NIMAN	(503) 243-4032
ED WEISS	(503) 243-4220

SEATTLE CITY LIGHT

DICK CHANG	(206) 625-3304

B.C. HYDRD AND POWER:

RALPH LEGGE	(604) 289-7719

PUGET SOUND POWER AND LIGHT:

BOB CLUBB	(206) 453-6871

WASHINGTON WATER AND POWER:

BOB D. ANDERSON	(509) 48g-0500, EXT. 2487

INTERCOMPANY POOL:

E.F. TIMME	(509) 489-0500

NORTHWEST POWER POOL:

BILL BOSSHART	(503) 253-4306

ATTACHMENT 7

MARCH 1981 and MARCH 1982 RUNOFF FORECAST

SEASONAL WATER SUPPLY FORECASTS
as of
March 1, 1982

			1000 AF	Percent (1962-77) Average
			April-September	
COLUMBIA RIVER	Mica Res. Inflow		13,700	104
	Mica Res. Inflow	(Feb-Sep)	14,100	104
	Arrow Lakes Inflow		27,400	105
	Arrow Lakes Inflow	(Feb-Sep)	28,600	106
	Birchbank, B. C.		49,100	108
	Grand Coulee, WA		74,300	109
	Grand Coulea, WA	(Jan-Jul)	72,500	110
	Rock Island, WA		82.000	111
	The Dalles, OR		117:ooo	113
	The Dalles, OR	(Jan-Jul)	126,000	115
KOOTENAI BASIN	Libby Res. Inflow		7,570	104
	Duncan Res. Inflow		2,460	108
	Duncan Res. Inflow	(Feb-Sep)	2,550	108
CLARK FORK RIVER	St. Regis, MT		4,920	109
FLATHEAD BASIN	Hungry Horse Res. Inflow		2.350	102
	Flathead Lake Inflow		7,400	100
PEND OREILLE RIVER	Pend Oreille Lake Inflow		17,600	105
SPOKANE BASIN	Coeur d'Alene Lake Inflow		3,120	107
OKANOGAN RIVER	Tonasket, WA		1,800	105
CHELAN RIVER	Lake Chelan Inflow		1,350	109
YAKIMA RIVER	Parker (nr), WA		2,350	108
MCKENZIE RIVER	Vida (nr), OR		1,390	114
SANTIAM RIVER	Waterloo, OR		648	111
	Mehama, OR		920	106
CLACKAMAS RIVER	Estacada, OR		865	111
WILLAMETTE RIVER	Salem, OR		5,160	110
COWLITZ RIVER	Mayfield Res. Inflow		2,440	115
	Mayfield Res. Inflow	(Apr-Jul)	2,130	115
			April-July	
SNAKE RIVER	Jackson Lake Inflow		1,000	124
	Heise, ID		4,240	120
	Weiser, ID		6,920	123
	Lwr Granite Res. Inflow		27,200	'119
	Lwr Granite Res. In	(Jan-Jul)	37,600	119
OWYHEE RIVER'	Owyhee Res. Inflow,	(Mar-Jul)	722	145
BOISE RIVER	Boise (nr), ID		1,950	127
PAYETTE RIVER	Horseshoe Bend, ID		2,240	130
SALMON RIVER	Whitebird, ID		8,080	124
CLEARWATER BASIN	Dworshak Res. Inflow		3,050	107
	Spalding, ID		8,620	105
UMATILLA RIVER	Pendleton, OR		172	119
JOHN DAY RIVER, MF	Ritter (nr), OR		136	125
CROOKED RIVER	Post (nr), OR	(Mar-Jul)	232	173

The above forecasts are selected from those prepared by National Weather Service, Soil Conservation Service, and B. C. Hydro and Power Authority. For various project inflows, forecasts have been coordinated with the Columbia River Forecast Service and U. S. Water & Power Resources Service.

3-9-82

SEASONAL WATER SUPPLY FORECASTS
As Of
March 1, 1981

			1000 AF April-September	Percent (1963-77) Average	Percent Change 2/1 to 3/1
COLUMBIA RIVER	Mica Res. Inflow	(Feb-Sep)	12,700	94	0
	Arrow Lakes Inflow	(Feb-Sep)	25,400	94	+ 1
	Birchbank, B. C.		43,400	95	+ 2
	Grand Coulee, WA		57,600	85	+ 1
	Grand Coulee, WA	(Jan-Jul)	55,800	85	+ 1
	Rock Island, WA		63,200	es	0
	The Dalles, OR		79,800	77	0
	The Dalles, OR	(Jan-Jul)	a4,500	77	0
KOOTENAI BASIN	Libby Res. Inflow		6,660	92	0
	Duncan Res. Inflow	(Feb-Sep)	2,310	98	+ 6
CLARK FORK RIVER	St. Regis, MT		2,600	58	- 8
FLATHEAD BASIN	Hungry Horse Res. Inflow		1,600	70	-18
	Flathead Lake Inflow		5,360	72	- 5
PEND OREILLE RIVER	Pend Oreille Lake Inflow		10,000	65	- 5
SPOKANE BASIN	Coeur d'Alene Lake Inflow		1,500	52	+ 1
OKANOGAN RIVER	Tonasket, WA		1,150	67	- 7
CHELAN RIVER	Lake Chelan Inflow		1,100	89	+ 4
YAKIMA RIVER	Parker (nr), WA		1,500	69	+ 1
MCKENZIE RIVER	Vida (nr), OR		906	74	- 3
SANTIAM RIVER	Waterloo, OR		419	73	+ 2
	Mehama, OR		585	68	- 2
CLACKAMAS RIVER	Estacada, OR		469	60	- 5
WILLAMETTE RIVER	Salem, OR		3,290	70	+ 1
COWLITZ RIVER	Mayfield Res. Inflow		1,590	75	- 5
	Mayfield Res. Inflow	(Apr-Jul)	1,390	75	- 5
			April-July		
SNAKE RIVER	Jackson Lake Inflow		572	71	- 1
	Heise, ID		2,460	70	-4
	Weiser, m		2,650	47	- 1
	Lwr Granite lies. Inflow		14,900	64	- 4
	Lwr Granite Res. in	(Jan-Jul)	20,400	64	- 4
OWYHEE RIVER	Owyhee Res. Inflow	(Mar-Jul)	181	36	-24
BOISE River	Boise (nr), ID		959	62	- 6
PAYETTE RIVER	Horseshoe Bend, m		1,230	72	0
SALMON RIVER	Whitebird, ID		4,880	75	- 5
CLEARWATER BASIN	Dworshak Res. Inflow		1,410	49	
	Spalding, ID		5,050	62	- 6
UMATILLA RIVER	Pendleton, OR		87	60	- 8
JOHN DAY RIVER, MF	Ritter (nr), OR	(Mar-Jul)	86	65	- 4
CROOKED RIVER	Post (nr), OR	(Mar-Jul)	85	63	- 3
DESCHUTES RIVER	Benham Falls, on	(Apr-Sep)	478	66	- 1

The above forecasts are selected from those prepared by National Weather Service, Soil Conservation Service, and B. C. Hydro and Power Authority. For various project inflows, forecasts have been coordinated with the Columbia River Forecast Service and U. S. Water & Power Resources Service.

Northwest River Forecast Center
March 9, 1981

ATTACHMENT *8*

CORRESPONDENCE

COLUMBIA RIVER INTER-TRIBAL FISH COMMISSION

8383 N.E. Sandy Blvd.
Suite 320
Portland. Oregon 97220
Telephone (503)
257-0181

February 16, 1982

COMMITTEE ON FISHERY OPERATIONS

Dear Sirs,

The Columbia Inter-Tribal Fish Commission is pleased to have participated in the development of the Implementation Procedure for the 1982 Fishery Operation Program. Nevertheless, the Commission will not concur in approving the 1982 Implementation Procedure unless the following Inter-Tribal positions are reflected in that document.

1. The Inter-Tribal position is that only optimum flows are consistent with Indian treaty obligations. However, the Commission recognizes that 1982 will be a year of transition. Thus, the Commission will support a COFO position to the effect that optimum flows must be provided unless monthly forecasts predict that it will be impossible to provide optimum flows as developed by the Columbia River Fisheries Council. In such a case, operating agencies must shape loads and arrange power purchases to provide for maximum juvenile migrant survival. In any case, Columbia River Fisheries Council minimum flows must be provided while smolts are migrating in the project areas.

Consequently, the Columbia River Inter-Tribal Fish Commission does not support the language of paragraph number one on page five insofar as this paragraph states that, ". . .<u>every attempt will be made</u> to shape flows to provide CRFC minimum flows or better while smolts are migrating in the project areas." (Emphasis added.)

The Commission takes this position because the words "every attempt will be made" provide no ascertainable standard for compliance.

2. The Commission is concerned that the "current FERC settlement agreement" refers to the Settlement Agreement in existence at the time of adoption rather than at the time of flow implementation. Instead, the Implementation Procedure must provide that reference is made to the FERC Settlement Agreement current at the time the procedure is used. Further. the member tribes of the Commission, by concurrence in this document do not acknowledge its consistency with treaty rights.

3. Finally, the Commission believes that the draft Detailed Operating Plan must be available by March 15, 1982, and be finalized by April 1,

1982. Consequently, paragraphs two and four on page ten describing the responsibilities of the Committee on Fishery Operations should be changed accordingly. The Commission believes this change is necessary due to data which indicates that smolts are migrating in the project areas during the first week of April.

Sincerely,

S. Timothy Wapato
Acting Executive Director

RCL

United States Department of the Interior
BUREAU OF RECLAMATION
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
PACIFIC NORTHWEST REGION
FEDERAL BUILDING & U.S. COURTHOUSE
BOX 043-550 WEST FORT STREET
BOISE, IDAHO 83724

IN REPLY REFER TO: PN 770
565.

FEB 3 1982

Mr. Jerry M. Conley, Director
Idaho Department of Fish and Game
600 South Walnut
Boise, Idaho 83707

Dear Mr. Conley:

This is in response to your letter concerning the Bureau of Reclamation's part in the 1982 fish operation program.

The Bureau has been working as a member of the Committee on Fishery Operations (COFO) since its beginning to help provide flow for the passage of fish in the mid-Columbia and plans to continue working in this effort in 1982. We understand your concern for flow to protect the survival of migrating smolts and the request for the highest possible flows, referred to as optimum, which during the period April 16 to June 15 for the mid-Columbia, amounts to over 1 million acre-feet more being added to the recommended minimum flows for the same period. Consequently, because of the potential impacts upon the authorized project purposes and the potential for the variability of the water supply from that forecasted, we prefer to plan on meeting the minimum fish flow recommendation for the 1982 fish operation. If the volume runoff forecast continues to look good, we would then make operational adjustments in releases from Grand Coulee to provide better than the minimum, the goal being the optimum or higher flows during the peak outmigration. We will also do what we can to help in assistance of flows on the Snake River. In any case, as we have in the past, we plan to work with the designated fishery agency coordinator, under COFO, to provide the best flows we can manage at the time they are requested.

Studies are still being made by the Instream Flow Work Group to determine impacts on system storage of providing different flow recommendations. These studies will continue to be made in an effort to complement, to the maximum extent possible, instream flow needs for fishery migration and the authorized project purposes and other uses.

Early results of the Instream Flow Work Group were used in the recommendation to the Northwest Power Council by the National Marine Fisheries Service. With completion of additional studies now being made? a report should be forthcoming, which will aid in our response to the fishery agencies' recommendation to the Northwest Power Council.

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

OFFICE OF THE ADMINISTRATOR

FEB 19 1982

In reply refer to: PSH

Mr. Harold Culpus, Chairman
Columbia River Inter-Tribal Fish Commission
8383 Northeast Sandy Boulevard, Suite 320
Portland, Oregon 97220

Dear Mr. Culpus:

Thank you for your letter of December 30, 1981, regarding necessary flows for the upcoming 1982 fish outmigration season. With the passage of the Pacific Northwest Electric Power Planning and Conservation Act (Regional Act), Bonneville Power Administration has an even greater responsibility to provide protection for the safe passage of spring outmigrants. Our responsibility to balance fishery needs with power needs is shared with the fishery agencies, the Corps of Engineers, and the Bureau of Reclamation.

The current January-July volume runoff forecast at The Dalles of 110 million acre-feet (normal runoff is 109.6 million acre-feet) indicates enough water to meet current power needs and optimum fishery flow requirements at Priest Rapids and The Dalles Dams. If the volume runoff forecast decreases significantly in subsequent months, it may be necessary to adjust the requested flow downward to balance the fishery and power requirements. In the Lower Snake Basin where we have limited storage and regulation capability, Dworshak reservoir has been held as high as flood control requirements allow in anticipation of the spring outmigration. However, it should be noted that regulation studies indicate Dworshak reservoir fails to fill 90 percent of the time when minimum CRFC flow requirements are applied to the 40 year record of historical streamflows.

Bonneville Power Administration personnel have already taken specific steps to assist the spring outmigration and augment flows. In particular, reservoirs have been held well above operating rule curves and water that could have been used to generate nonfirm energy is being reserved for the 1982 fish flow operation. As of January 27, 1982, total storage above operating rule curves in Federal reservoirs above The Dalles was 4.6 million acre-feet. Secondly, Bonneville Power Administration personnel are negotiating with utilities outside the region to store excess hydro-generation resulting from the fish operation.

Bonneville Power Administration will continue to actively support the objectives of the fishery agencies by participating on the Committee on Fishery Operations (COFO). We are looking forward to working with you and other fishery agencies this year as in past years.

Sincerely,

Peter T. Johnson
Administrator

cc:
Brig. General James W. van Loben Sels, COE
Mr. John W. Keyes III, USBR
Mr. Charles M. Butler III, FERC

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

OFFICE OF THE ADMINISTRATOR

FEE 19 1982

In reply refer to: PSH

Mr. H. A. Larkins, Regional Director
National Marine Fisheries Service
Northwest Region
7600 Sand Point Way Northeast
Seattle, Washington 98115

Dear Mr. Larkins:

Thank you for your letter bf January 12, 1982, regarding necessary flows for the upcoming 1982 fish outmigration season. With the passage of the Pacific Northwest Electric Power Planning and Conservation Act (Regional Act), Bonneville Power Administration has an even greater responsibility to provide protection for the safe passage of spring outmigrants. Our responsibility to balance fishery needs with power needs is shared with the fishery agencies, the Corps of Engineers, and the Bureau of Reclamation.

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Sincerely,

Peter T. Johnson

Administrator

cc:
Brig. General James W. van Loben Sels, COE
Mr. John W. Keyes III, USBR
Mr. Charles M. Butler III, FERC

Identical letter to:

Mr. H. A. Larkins, Regional Director
National Marine Fisheries Service
Northwest Region
7600 Sand Point Way Northeast
Seattle, Washington 98115

Mr. Rolland A. Schmitten, Director
Washington State Department of Fisheries
Room 115, General Administration Building, AX-11
Olympia, Washington 98504

Mr. Jerry M. Conley, Director
Idaho Department of Fish and Game
600 South Walnut, Box 25
Boise, Idaho 83707

Mr. Harold Culpus, Chairman
Columbia River Inter-Tribal Fish Commission
8383 Northeast Sandy Boulevard, Suite 320
Portland, Oregon 97220

Dr. John R. Donaldson
Director
Oregon Department of Fish and Wildlife
506 Southwest Mill Street
P.O. Box 3503
Portland, Oregon 97208

Mr. Richard J. Myshak, Regional Director
United States Department of Interior
Fish and Wildlife Service
Lloyd 500 Building, Suite 1692,
Portland, Oregon 97232

VICTOR ATIYEH
GOVERNOR

Department of Fish and Wildlife

506 S.W. MILL STREET. P.O. BOX 3503, PORTLAND, OREGON 97208

January 12, 1982

Kenneth F. Plum, Secretary
Federal Energy Regulatory Commission
825 North Capitol Street, N.E.
-Washington, D.C. 20426

DUPLICATE ORIGINALS: Peter Johnson, BPA; General Van Loben Sels, USACE; William T. Lloyd, BOR.

Dear Mr. Plum:

I am sure you are aware of the depressed condition of the upriver runs of salmon and steelhead. This condition is the direct result of the development of the Columbia system for hydropower and is associated primarily with the effects of delay to downstream migrants brought about by this development. This delay has been caused by upriver storage of the spring runoff, the creation of deep impoundments where water moves more slowly than formerly, and the direct effect of dams as a barrier to fish movement. Direct and indirect mortalities associated with turbine passage are, of course, also important sources of loss which must be addressed through the installation of adequate bypass facilities at dams.

Since the downstream migration of spring and summer chinook in 1982 is expected to be near the record low of 1980, it is critical that every effort is made to provide sufficient flow to move these fish to the ocean with minimal delay. The flow regime required has been detailed in the attached optimum flow recommendations of the Columbia River Fisheries Council.

We realize that the Regional Power Plan will not take effect until 1983, but believe that your agency has an obligation under the Regional Power Act to make every effort to balance the needs of fish with those of other water users in this interim year. We hope that you will use all of the flexibility in the system that is at your disposal to provide the necessary flows.

We plan to work through the Committee on Fishery Operations (COFO) as we have in the past in an attempt to develop a Plan for downstream migrant protection in 1932. We are hoping that your agency's representatives in this process will be given greater flexibility, reflecting the changed status of fisheries required by the Regional Power Act. We are hopeful that in the future fishery flow requirements will be incorporated into the planning and operation of the Federal Columbia River Power System.

Sincerely,

for

John R. Donaldson, PhD
Director

fyp
Attachment
cc: CRFC members

United States Department of the Interior
BUREAU OF RECLAMATION
PACIFIC NORTHWEST REGION
FEDERAL BUILDING & U.S. COURTHOUSE
BOX 043-550 NEST FORT STREET
BOISE, IDAHO 83724

IN REPLY REFER TO: PN 770
565.

FEB 3 1982

Mr. John R. Donaldson, Ph.D., Director
Department of Fish and Wildlife
P.O. Box 3503
Portland, Oregon 97208

Dear Mr. Donaldson:

This is in response to your letter concerning the Bureau of Reclamation's part in the 1982 fish operation program.

The Bureau has been working as a member of the Committee on Fishery Operations (COFO) since its beginning to help provide flow for the passage of fish in the mid-Columbia and plans to continue working in this effort in 1982. We understand your concern for flow to protect the survival of migrating smolts and the request for the highest possible flows, referred to as optimum, which during the period April 16 to June 15 for the mid-Columbia, amounts to over 1 million acre-feet more being added to the recommended minimum flows for the same period. Consequently, because of the potential impacts upon the authorized project purposes and the potential for the variability of the water supply from that forecasted, we prefer to plan on meeting the minimum fish flow recommendation for the 1982 fish operation. If the volume runoff forecast continues to look good, we would then make operational adjustments in releases from Grand Coulee to provide better than the minimum, the goal being the optimum or higher flows during the peak outmigration. We will also do what we can to help in assistance of flows on the Snake River. In any case, as we have in the past, we plan to work with the designated fishery agency coordinator, under COFO, to provide the best flows we can manage at the time they are requested.

Studies are still being made by the Instream Flow Work Group to determine impacts on system storage of providing different flow recommendations. These studies will continue to be made in an effort to complement, to the maximum extent possible, instream flow needs for fishery migration and the authorized project purposes and other uses.

Early results of the Instream Flow Work Group were used in the recommendation to the Northwest Power Council by the National Marine Fisheries Service. With completion of additional studies now being made, a report should be forthcoming, which will aid in our response to the fishery agencies' recommendation to the Northwest Power Council.

We plan to continue our efforts in COFO and look forward to working with you in a cooperative and objective spirit to meet the water supply needs of the Pacific Northwest.

Sincerely yours,

L.W. Lloyd

Regional Director

NPDEN-WM

5 February 1982

Mr. John R. Donaldson, PhD
Department of Fish and Wildlife
P.O. BOX 3503
Portland, OR 97208

Dear Mr. Donaldson:

Thank you for your recent letter concerning this year's Fishery Operating Plans to assist juvenil migrants in the Lower Snake and Columbia Rivers. I have received similar letters from other fishery interests and I especially appreciate the offers of cooperation and support for an equitable plan for fishery and power and the other valuable purposes for which we operate the reservoir system.

Although their task will not be easy, I am optimistic that the efforts of the Northwest Power Planning Council in finding an equitable plan for fishery and power and the other beneficial uses served by the water resource will be fruitful. I am hopeful that the plan they adopt will be fully supported by all fishery agencies, Indian tribes, utilities and power interests, the States, as well as the multipurpose operating agencies such as the Corps of Engineers and the Bureau of Reclamation. In the meantime, we also intend to work thru the Committe on Fishery Operations (COFO) forum as we have in the past, to develop an interim operating plan for providing instream flow assistance this year. We intend, however, to keep cognizant of the flow recommendations presented to the Regional Council and to review our operational decisions to determine the extent we can achieve those flow proposals this year and to become more aware of the potential for implementing those recommendatons in the future.

We have experienced above-average precipitation in the Basin so far this winter and the current volume forecast is for better-than-average runoff &his year. If average precipitation continues into the spring months, I am confident that the Columbia River Fisheries Council's minimum flows can be achieved and that periods of optimum flow conditions can be provided, especially on the Columbia River. Attainment of optimum flow levels for the Snake River will pose a significant challenge unless precipitation and snowpack accumulation on the Clearwater and Snake Basins exceed normal amounts iu coming weeks.

In accordance with COFO Implementation procedures, I will review the March runoff forecast and provide you more specific information on proposed operations at that time. We understand the urgency and importance of your requested instream flow assistance during the juvenile outmigration period and we will strive to we available flexibility we have to achieve the fish flow requests.

Sincerely,

JAMES W. VAN LOBEN SELS
Brigadier General, USA
Commanding

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
i;orthwest Region
7600 Sand Point Way N.E.
BIN C15700
Seattle, Washington 98115

F/NWR5

Mr. Peter Johnson
Bonneville Power Administration
P.O. Box 3621
Portland, Oregon 97208

Dear Mr. Johnson:

For the past several years fishery agencies and Indian representatives have met with river management agencies to plan for the release of Columbia Basin waters to achieve suitable river conditions for the successful spring migration of juvenile salmon and steelhead. Each year the National Marine Fisheries Service (NMFS) has participated in the Committee on Fishery Operations (COFO) in an attempt to obtain the river flow and spill conditions necessary for survival of migrating smolts to perpetuate the fish runs and the sport, commercial and Indian harvests of these stocks of fish. Working through COFO to improve conditions for fisheries has met with limited success, however, since system operations and management flexibility have already been committed to maximizing power production.

NMFS requests your cooperation this year in operating the hydroelectric system to achieve flows and spills necessary for improved survival and harvest of upriver salmon and steelhead populations. It must be recognized that passage of the Pacific Northwest Electric Power Planning and Conservation Act has imposed certain, immediate responsibilities for fisheries that do not depend upon the development and adoption of the Fish and Wildlife Program required by Section 4(h) of the Act.

Among the purposes of the Northwest Power Act signed into law in December, 1980, operations of the Federal Columbia River Power System (FCRPS) are to protect, mitigate and enhance anadromous fish". . .which are dependent on suitable environmental conditions substantially obtainable from the management and operation of the Federal Columbia River Power System and other power generating facilities on the Columbia River and its tributaries." [Sec 2(6)]. In order to achieve this purpose, the Act recognizes the need for FCRPS operations which provide ". . . flows of sufficient quality and quantity between such (hydroelectric) facilities to improve production, migration, and survival of such fish as necessary to meet sound biological objectives." [(Sec 4(h)(6)(E)(ii)]. The Act further directs that. "The Administrator and other Federal agencies responsible for managing, operating, or regulating Federal or non-Federal hydroelectric facilities located on the Columbia River or its tributaries shall (i) exercise such responsibilities consistent with the purposes of this Act and other applicable laws, to adequately protect, mitigate, and enhance fish and wildlife, including related spawning grounds and habitat, affected by such projects or facilities in a manner that provides <u>equitable treatment</u> for such fish and wildlife with the other purposes for which such system and facititics are managed and operated." [Sec 4(h)(11(A) (emphasis added)].

The National Marine Fisheries Service realizes that in the spring of 1981, annual planning under the Pacific Northwest Coordination Agreement committed much of the FCRPS management flexibility for spring 1982 to firm power production. However, given that the mandate of the Northwest Power Act to improve fisheries was instituted prior to 1981 and that a basic principle of the Coordination Agreement allows operations necessary for nonpower uses, adjustments, if needed, should be undertaken to provide flows and spills for fish passage. With present firm power demand significantly below the 1981 forecast, these nonpower operations are more feasible. Inter-regional power exchange agreements, short term power purchases, and/or other power supply options allowed under the Northwest Power Act and previous authorities also provide a number of alternatives "to assure the Pacific Northwest of an adequate, efficient, economical and reliable power supply," [Sec 2 (1)(B)].

Both the Northwest Power Act and Indian treaties require the water and power management agencies to provide flows and spills to allow sufficient survival of juvenile salmon and steelhead in the Columbia Basin The Act, however, also provides. for an adequate, efficient, economical, and reliable power supply and directs a-balancing in river management for fisheries and power production; losses to both purposes could be necessary under conflicting circumstances. The Indian treaties however, mandate that the decisions and actions of the river management agencies must protect salmon and steelhead resources. Operation of FCRPS must not infringe upon the protection of these resources secured by treaty.

The National Marine Fisheries Service believes that optimum flows and spill recommended by the Columbia River Fisheries Council for the Snake and Columbia River (attached) should be implemented in the spring 1982 to be responsive to the mandates of the Northwest Power Act and Indian treaties. Given the reduction in firm power loads, the runoff conditions likely to occur this spring, and power exchange and storage options available, planning to implement these flows and spill should be initiated immediately and actively pursued.

The National Marine Fisheries Service will continue coordinating fishery flow requirements in 1982 through COFO as it provides at least an ad-hoc forum for discussing the management and opcrotions goals of the water and power management entities. We will continue, to support, however, permanent incorporation of fishery flows in the planning and operation of FCRPS for future years.

Sincerely,

H. A. Larkins
Regional Director

Attachment

Optimum Flow Recommendations

(1,000's cfs)

	Bonneville	McNary	Lower Snake	Priest R.
January	110	100	20	70
February	110	100	20	70
March	110	100	20	70
April				
1-15	190	180	100	70
16-25	225	215	110	100
26-30	250	245	120	120
May	300	290	140	140
June				
1-15	250	250	120	120
16-30	200	190	90	90
July	Research required to define optimum flows during this period			
1-15				
16-31				
August				
September				
October				
November				
December	110	100	20	70

COLUMBIA RIVER INTER-TRIBAL FISH COMMISSION

8383 N.E. Sandy Blvd.
Suite 320
Portland, Oregon 97220
Telephone (503)
257-0181

December 30, 1981

Mr. Peter Johnson
Administrator
Bonneville Power Administration
P.O. Eox 3621
Portland., OR 97208

Mr. Charles M. Butler III, Chairman
Federal Energy Regulatory Commission
825 N. Capitol St. N.E.
Washington, D.C. 20426

Mr. John W. Keyes III
Assistant Regional Director
Bureau of Reclamation
Box 043-550
Boise, ID 83724

Brig. General James W. van Loben Sels
Division Engineer, North Pacific Division
U.S. Corps of Engineers
P.O. Box 2870
Portland, OR 97208

Dear Sir;

The Columbia River Inter-Tribal Fish Conission requests your cooperation and coordinated action to assure that the operation of hydro-electric facilities on the Columbia River and its tributaries during spring and summer of 1962 provide adequate flows and spills for juvenile anadrcmous fish migrating to the Pacific Ocean; The commission is composed of the fish and wildlife committees of the Yakima, Warm Springs, Umatilla, and Nez Perce Indian tribes. These tribes hold fishing rights on the Columbia River and its tributaries secured by treaties with the United States.

The commission regards the protection of migrating juvenile salmon and steelhead as a matter of the greatest importance. In order to further the Columbia River treaty tribes' interest in the protection of treaty fish resources, the commission participates in the Committee on Fishery Operations (COFO) which is attempting to coordinate the operation of the hydro-electric system to provide flows and spills necessary for the survival of anadronous fish in the upper Columbia River system. It is the Commission's position, and its recommendation, that optimum flows and spills (as developed and adopted by the Columbia River Fisheries Council) must be provided in the Columbia and Snake Rivers. Further, it is the position of the commission that only through the provision of optimum flows and spills will the actions of your agency be consistent with Indian treaty fishing and water rights and with the corollary trust responsibility of your agency to protect resources secured by treaties. While the provision of optimum flows is also consistent with the requirements of P.L. 96-501, the Regional Power Act, requiring "equitable treatment" for fish and wildlife, your responsibilities under the treaties between the United States and Indian tribes are not diminished by the Regional Power Act as indicated in Section 10(e) of the Act. In <u>Confederated Tribes of the Umatilla Indian Reservation v. Callaway</u>, No.

72-211 (D. Or. 1973), the federal court reiterated that federal water managment agencies lack the statutory authority to operate or regulate hydro-electric dams in a manner that would impair or destroy the fishing rights of Columbia River treaty tribes. This holding has been reiterated in other cases including Confederated Tribes of the Umatilla Indian Reservation v. Alexander, 440 F. Supp. 553 (D. Or. 1977), Kittitas Reclamation District v. Sunnyside Valley Irrigation District, No.21 (E. D. Wash. Nov. 28, 1980), aappeal noted (Nov. 26, 1980) and United States v. Anderson, No. 3643 (E. D. Wash. July 23, 1979).

The holdings in these cases are particularly pertinent to the question of providing adequate fish flows in times of scarcity. Though various options to share shortages during times of scarcity have been advanced, 'most of those options assume that the fisheries are a "soft constraint" on the operation of the river. Our commission understands, however, that the Columbia River hydro-power system maintains substantial unused flexibility for dealing with fishery-related requirements. The shaping of load, the shifting of firm energy load carrying capacity, and the purchase of power from non-hydro sources within and outside of the region offer opportunities to utilize this flexibility. In order to take advantage of these opportunities, the commission believes that optimum flows must be incorporated as a "hard constraint" thereby requiring operations managers to determine and implement the means of adjusting the power system to provide equitable treatment for the fisheries in accordance with the Regional Power Act and other applicable laws and treaties. Further, the nature of the Columbia River tribes' treaty fishing and water rights substantially elevates the level of consideration that federal agencies must afford the protection of fish resources.

Because of its useful role in coordinating the goals of various entities entrusted with the management of the Columbia River hydro-power system, our commission will continue participation in COFO and is cooperating with the other fishery agencies in developing draft language for the CCFO implementation plan. Once a plan is adopted, we intend to continue our participation in implementing the plan and, if necessary, participating in the dispute resolution process established in previous years.

As you are surely aware, upper river salmon runs have reached their lowest levels in history partially, as a result of the operations. of dams on the Columbia River and its tributaries for other purposes. It is our commission's view that a cooperative effort on the part of all water management agencies and fishery agencies in accordance with the Regional Power Act, our treaties, and other law is the best means for solving this critical problem facing the Pacific Northwest.

Sincerely,

Harold Culpus

Harold Culpus
Chairman

cc: Regional Director, National Marine Fisheries Service
Manager, Grant County Public Utiiity District
Manager, Chelan County Public Utility District
Manager, Douglas County Public Utility District
Director, Oregon Department of Fisheries
Director, Washington Department of Fisheries
Director, Washington Department of Game
Director, Idaho Department of Fish and Game
Regional Director, U.S. Fish and Wildlife Service

United States Department of the Interior
BUREAU OF RECLAMATION
PACIFIC NORTHWEST REGION
FEDERAL BUILDING & U.S. COURTHOUSE
BOX 043-550 WEST FORT STREET
BOISE, IDAHO 83724

IN REPLY REFER TO: PN 770
565.

FEB 3 1982

Mr. H. A. Larkins, Regional Director
National Marine Fisheries Service
Northwest Region
7600 Sand Point Way NE.
BIN C15700
Seattle, Washington 98115

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We plan to continue our efforts in COFO and look forward to working with you in a cooperative and objective spirit to meet the water supply needs of the Pacific Northwest.

Sincerely yours,

L. W. Floyd

Regional Director

DEPARTMENT OF THE ARMY
NORTH PACIFIC DIVISION. CORPS OF ENGINEERS
P.O. BOX 2870
PORTLAND, OREGON 97208

NPDEN-WM 5 February 1982

a. A. Lerkins
United States Department of, Commerce
National Oceanic and Atmospheric Administration
National Marine Fisheries Service
Northwest Region
7600 Sand Point Way N.E.
BIN C 15700
Seattle, WA 98115

Dear Hr. Larkins :

Thank you for your recent letter concerning this year's Fishery Operating Plans to assist juvenile migrants in the Lower Snake and Columbia Rivers. I have received similar letters from other fishery interests and I especially appreciate the offers of cooperation and support for an equitable plan for fishery and power and the other valuable purposes for which we operate the reservoir system.

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Sincerely,

JAMES W. VAN LOBEN SELS
Brigadier General, USA
Commanding

ATTACHMENT 10

1982

PROPOSED HATCHERY PLANTING SCHEDULE

ABOVE BONNEVILLE DAM

1982

PROPOSED HATCHERY PLANTING SCHEDULE

ABOVE BONNEVILLE DAM

SPRING CHINOOK

Hatchery	Brood	Size*	Number	Planting Location	Date
Rapid R.	1980	15	1,200,000	Rapid R.	April 19.82
Rapid R.	1980	15	200,000	Snake R. below Hells Canyon Dam	March 1932
Hayden Cr.	1980	25	17,000	Hayden Cr.	April 1982
Red R. Pond	1981	40	200,000	Red River	Sept. 1982
Winthrop	1980	15	1,000,000	Methow R. (hatchery)	April 15, 1982
Entiat	1930	15	1,100,000	Entiat R. (hatchery)	April 15, 1982
Leavenworth	1980	17	2,250,000	Icicle Cr. (hatchery)	April 15, 1982
Leavenworth	1930	15	400,000	Yakima	April 15, 1982
Carson	1980	20	2,680,000	Hind R. (hatchery)	April 15, 1982
L.Wh. Salmon	1980	12	600,000	L.Wh. Salmon (hatch)	April 15, 1982
Warm Springs	1980	20	180,000	Warm Sprgs R. (hatch)	April 1, 1982
Kooskia	1980	110 MM	550,000	At hatchery	4/13-15/82
Oxbow	1980	6	490,000	Lookingglass Cr.	April 1932
Round Butte	1980	5	55,000	Deschutes R.	April 1982
Round Butte	1931	6	30,000	Deschutes R.	Oct. 1982
Round Butte	1981	12	60,000	Deschutes R.	Oct. 1982
Klickitat	1980	3	703,000	Klickitat R. (at hatchery)	3/15/82
Klickitat	1931	500	500,000	Klickitat R. (at hatchery)	1/20/82
Klickitat	1981	500	500,000	Klickitat R. (at hatchery)	2/1/82
Priest Rapids	1980	8	220,000	Columbia R. (hatch)	3/25/82

*Number per pound or length in MM.

1982

PROPOSED HATCHERY PLANTING SCHEDULE

ABOVE BONNEVILLE DAM

SUMMER CHINOOK

Hatchery	Brood	Size*	Number	Plantinq Location	Oate
McCall	1980	15	143,000	S.Fk. Salmon R.	April 1982
Wells	1981	35	2,400,000	Columbia R.(hatchery)	6/l/82
Rocky Reach	1980	9	110,000	Columbia R.(hatchery)	5/3-7/82
Rocky Reach	1981	100	300,000	Columbia R.(hatchery)	6/15/82

* Number per pound.

1982

PROPOSED HATCHERY PLANTING SCHEDULE

ABOVE BONNEVILLE DAM

COHO

Hatchery	Brood	Size*	Number	Planting Location	Date
L.Wh. Salmon	1980	25	1,200,000	L.Wh. Salmon (hatchery)	5/15/82
L.Wh. Salmon	1980	25	1,300,000	L.Wh. Salmon (hatchery)	5/15/82
Klickitat	1980	17-19	1,500,000	Klickitat R. (hatchery)	4/15/82
Rocky Reach	1980	13	440,000	Columbia R. (hatchery)	5/3-7/82

* Number per pound.

1982

PROPOSED HATCHERY PLANTING SCHEDULE

ABOVE BONNEVILLE DAM

FALL CHINOOK

Hatchery	Brood	Size*	Number	Planting Location	Date
L.Wh. Salmon	1981	100	7,800,000	L.Wh.Salmon (hatchery)	6/1/81
Hagerman	1981	100-120MM	900,000	L.Granite Dam-Asotin	5/1-6/15/82
Klictitat	1981	85	4,000,000	Klickitat R. (at hatchery)	6/4/82
Priest Rapids	1981	70	840,000	Columbia R. (hatchery)	5/20/82
Priest Rapids	1981	70	5,000,000	Columbia R. (hatchery)	6/20/82
Ringold	1980	7	775,000	Columbia R. (hatchery)	3/29-4/8/82
Spring Creek	1981	110	7,200,000	Columbia R. (hatchery)	3/25/82-4/1/82
Spring Creek	1981	85	2,400,000	Columbia R. (hatchery)	4/15/82
Spring Creek	1981	55	3,400,000	Columbia R. (hatchery)	5/5/82
Spring Creek	1981	90	1,000,000	Columbia R. (J.D. Pool)	4/1-15/82
Spring Creek	1981	1 2	250,000	Columbia R. (hatchery)	8/1/81
(Oxbow	1981	80	3,000,000	Columbia-RM. 215	May 1982)

(Dependent on development and approval of a plan)

* Number per pound or length in MM.

1982

PROPOSED HATCHERY PLANTING SCHEDULE

ABOVE BONNEVILLE DAM

STEELHEAD

Hatchery	Brood	Size*	Number	Planting Location	Date
Niagara Springs	1581	5	1,200,000	Pahsimeroi R.	Mar/Apr 82
Niagara Springs	1981	7	400,000	Snake R. - below Hells Canyon Dam	Feb/Mar 82
Leavenworth	1980	7	100,000	Icicle Cr. (hatchery)	May 15, 1982
Wells	1981	6	450,000	Methow R.	4/15-5/10/82
Chelan PUD	1981	6	35,000	Entiat R.	4/15-5/10/82
Chelan PUD	1981	6	160,000	Wenatchee R.	4/15-5/10/82
Turtle Rock	1981	6	20,000	Columbia R-Turtle Rock	4/15-5/10/82
Turtle Rock	1981	6	120,000	Wenatchee R.	4/15-5/10/82
Ringold Pond	1981	6	180,000	Columbia R-Ringold	4/15-4/30/82
Naches	1981	6	50,000	Naches R.	4/15-5/15/82
Naches	1981	6	50,000	Klickitat R.	4/15-5/15/82
Tucannon	1981	7	100,000	Grande Ronde R.	4/19-5/15/82
Dworshak	1980	180 MM	160,000	At hatchery	4/12-16/82
Dworshak	1980	180 MM	500,000	At hatchery	4/19-23/82
Dworshak	1981	180 MM	500,000	At hatchery	4/26-30/82
Dworshak	1981	180 MM	500,000	At hatchery	5/3-7/82
Dworshak	1931	180 MM	500,000	S.Fk. Clearwater	5/10-14/82
Dworshak	1981	180 MM	500,000	At hatchery	5/17-21/82
Dworshak	1981	180 MM	170,000	At hatchery	5/24-28/82
Hagenan	1981(A)	215 MM	60,000	Pahsimeroi (mouth)	3/29-4/2/82
Hagerman	1981(B)	215 MM	60,000	Pahsimeroi (mouth)	3/29-4/2/82
Hager-man	1981(A)	228 MM	400,000	U.Salmon R. above Pahsimeroi; E.Fk.Salmon & Flat Area	4/1-30/82
Hagerman	1981(B)	203 MM	70.000	S. Fk. Salmon	5/7-14/82

* Number per pound or length in MM.

1982

PROPOSED HATCHERY PLANTING SCHEDULE

ABOVE BONNEVILLE DAM

STEELHEAD (page 2 of 2)

Hatchet-v	Brood	Size*	Number	Planting Location	Date
Oak Springs	1981	5	80,000	Hood R. System	April 1982
Oak Springs	1981	5	60,000	Umatilla R.	April 1982
Round Butte	1981	5	162,000	Deschutes R.	April 1982
Wallowa	1980	5	44,000	Wallowa R.	April 1982
Waliowa	1981	6	136,000	Wallowa R.	April 1982

* Number per pound.

COLUMBIA RIVER INTER-TRIBAL FISH COMMISSION

March 30, 1982

8383 N.E. Sandy Blvd.
Suite 320
Portland, Oregon 97220
Telephone (503) 257-0181

COMMITTEE ON FISHERY OPERATIONS

Dear Sirs:

For the past several years, the Columbia River Inter-Tribal Fish Commission has participated in the Committee on Fishery Operations in an attempt to provide river flows and spills necessary to rebuild the depressed salmon and steelhead runs of the Columbia River and its tributaries. In light of the recently enacted Northwest Electric Power Planning and Conservation Act, the Commission was hopeful that meaningful and precedential operating plans could be developed out of this year's process. However, due only to the high expected runoff in 1982 were fishery agencies and tribes able to reach any sort of understanding with river operating entities. While the COFO process has been a beneficial cooperative effort, the intransigency of river and power management entities in the COFO process has consistently resulted in very limited river operations for the benefit of salmon and steelhead. It is evident that fisheries are still treated as a "soft" constraint by river management agencies. Such treatment is a far cry from the mandates of the Regional Power Act. Consequently the Commission believes that an additional mechanism must be established such that fisheries will be treated as a "firm" obligation of the hydroelectric system of the Columbia River and its tributaries.

In the current institutional setting, COFO is constrained by power planning decisions made in previous years. In this situation, the salmon and steelhead of the Columbia River are not co-equal partners with power production. The Columbia River tribes hold rights to essential environmental conditions necessary to protect their treaty right to take fish at all usual and accustomed fishing places. These environmental conditions include access to and from the sea, as well as an adequate supply of good quality water. United States v. Washington, 506 F. Supp. 187, 208 (W.D. Wash. 1980). Combined, the authorities contained in the Regional Power Act and Indian treaty obligations require more than an informal, non-binding, and cooperative discussion. Rather, these authorities require affirmative protection of fisheries at a minimum equal to the protection which is provided to power production.

The following specific comments of the Inter-Tribal Fish Commission are made in reference to this year's detailed operating plan developed by the COFO work group.

1. The Commission believes that maximum protection must be provided for all migrating salmon and steelhead. Consequently, the

references to CRFC daily average minimum flows should be CRFC daily average optimal flows. Recognizing that 1982 will be a year of transition, the Commission nevertheless takes this position in light of the predictions of better than average runoff conditions.

2. Throughout the Detailed Plan qualifications are made which generally state that "every effort" will be made to . . . . Because the phrase "every effort" provides no immediate or easily ascertainable standard for compliance, this phrase should be stricken from the plan wherever it appears.

3. The Commission believes that at least 50% spill must be provided at Lower Monumental, Dam whenever smolts are present Such a requirement would eliminate dam operations which are poorly coordinated with juvenile migrant passage. Additionally, existing practices which protect only 80% of these migrants are unacceptable to the Commission.

4. The spill policy for John Day Dam which protects only 80% of the migration is unacceptable to the Commission.

5. Transportation of migrating salmon is not viewed by the Commission as an acceptable substitute for protection of natural habitat. Transportation of chinook smolts has not proved to be effective. Consequently the Commission objects to collection and transportation of salmon smolts from Lower Granite, Little Goose and McNary Dams as the only accepted method of facilitating their migration.

The Commission hopes that these comments will be taken into serious consideration for this year's fishery operations and in the development of subsequent fish flow policies.

Sincerely,

S. Timothy Wapato

S. Timothy Wapato
Acting Executive Director

cc: CRITFC Members
Tribal Attorneys
Tribal Biologists

RL:src

COLUMBIA RIVER FISHERIES COUNCIL

LLOYD BUILDING • SUITE 1240
700 N. E. MULTNOMAH STREET
PORTLAND, OREGON 97232

FTS 429-2341

OFFICE OF
EXECUTIVE SECRETARY

April 13, 1982

Peter T. Johnson, Administrator
Bonneville Power Administration
P. O. Box 3621
Portland, Oregon 97208

Similar letter to Gen. van Loben Sels

Dear Mr. Johnson

The Columbia River fisheries Council has reviewed the projected flows and spill for the spring of 1982 and wishes to redeffne its position regarding the use of transportation for this year.

When the CRFC members assisted in the development of the detailed operations Plan. the assoctated runoff was as it is now Optimum flows are expected to be available through most of the migration. Upriver spring and salmon populations are in critical condition and require special consideration

The Counsil respectfully requests thrt Toads and spill not be shaped to maximize the collection and transportation of chinook salmon smolts The first priority for shaping loads and spill should be to provide the maximum survival of' juvenile migrants as they pass mainstem drams on thefr downstream migration. Particular emphasis must be placed on spilling at dams without adequate bypass systems such as Jon Day Dam. The sencond priaority for h&p-ing loads and spill should be the control of supersaturated gas levels.

These migrants that enter the collection systems that are operating under reduced powerhouse loading should be transported in the normal manner

recognizing that transportation has benefitted upriver steelhead populations when yearling chinook smolt numbers decline at the collector dams will recquest that the Corps and BPA return to shaping loads to maximize collection and transportation of steelhead smolts.

This request is consistant with the CRFC long-standing policy that the pre-ferred manner of protecting downstream migrants is to provide adequate flows and safe by passat all mainstem dams Fortunately, sufficiant stream flows and available spill should provide good survival conditions for all migrants this year.

Sincerely,

William R. Wilkerson

William R. Wilkerson
Chai ml?

cc: PPC
CRFC Members
COFO Members

COLUMBIA RIVER INTER-TRIBAL FISH COMMISSION
IDAHO DEPARTMENT OF FISH & GAME
NATIONAL MARINE FISHERIES SERVICE
OREGON DEPARTMENT OF FISH & WILDLIFE

U. S. FISH & WILDLIFE SERVICE
WASHINGTON DEPARTMENT OF FISHERIES
WASHINGTON DEPARTMENT OF GAME

COLUMBIA RIVER FISHERIES COUNCIL
LLOYD BUILDING • SUITE 1240
700 N. E. MULTNOMAH STREET
PORTLAND, OREGON 97232

(503) 231-2341
FTS 429-2341

OFFICE OF
EXECUTIVE SECRETARY

May 18, 1982

Brigadier General James W. van Loben Sels
Division Engineer, North Pacific Division
Corps of Engineers
P.C. Box 2970
Portland, Oregon 97208

Dear General van Loben Sels:

The fish and wildlife agencies and treaty Indian tribes working through the Columbia River Fisheries Council for improvement of the anadromous fisheries resources of the Columbia River Basin recommend that the collection and transportation of juvenile steelhead be maximized at the Lower Granite and Little Goose projects starting on May 17, 1982. Any chinook salmon juveniles tnat are collected should also be transported.

If control of dissolved gases requires distribution of spill to Lower Granite and Little Goose, the Columbia River Fisheries Council recommends that the objective of maximizing transportation of juvenile steelhead be given secondary consideration to control of dissolved gases and providing safe passage for migrants.

Your cooperation in this important streamflow masagcmcnt project has been appreciated.

Sincerely,

Bill Wilkerson

William R. Wilkerson
Chairman

CC: Peter Johnson, BPA
Dan Evans, PPC
CRFC Members
COFO Members

DEPARTMENT OF THE ARMY
NORTH PACIFIC DIVISION, CORPS OF ENGINEERS
P.O. BOX 2870
PORTLAND, OREGON 97208

KW

RECEIVED

MAY 2 8 1982

NPDEN

24 May 1982

FOR YOUR INFORMATION
COLUMBIA RIVER FISHERIES COUNCIL

Mr. William R. Wilkerson
Chairman, Columbia River Fisheries Council
Lloyd Bldg., Suite 1240
700 NE Multnomah St
Portland, OR 97232

xc: CRFC members

Dear Mr. Wilkerson:

In response to your letter of May 19, 1982, we are closely monitoring reservoir regulation to attempt to provide your requested flow levels in the mid-Columbia River reach during 19-26 May 1982.

As I am sure you recognize, provision of specific flow amounts is contingent on several factors including actual runoff conditions, power demand, flood regulation, reservoir refill, and others.

Thank you for your continued interest and input on the juvenile fish flow program.

Sincerely,

JAMES W. VAN LOBEN SELS
Brigadier General, USA
Division Engineer

COLUMBIA RIVER FISHERIES COUNCIL
LLOYD BUILDING • SUITE 1240
700 N. E. MULTNOMAH STREET
PORTLAND, OREGON 97232

(503) 231-2241
FTS 429-2241

OFFICE OF
EXECUTIVE SECRETARY

June 3, 1982

Mr. Peter Johnson
Administrator
Bonneville Power Administration
P.O. Box 3621
Portland, Oregon 97208

Dear Mr. Johnson:

The energy storage agreement with B.C. Hydro has been a positive factor in the control of excessive spill at mainstem Columbia River and Snake River Projects in recent days. Storage of energy at the Williston Project on the Peace River in British Columbia could also provide positive fishery benefits during the summer months. A part of the energy returned from the Williston Project could be used to displace generation at the John Day Project so that a portion of the flow can be spilled in the summer months tc provide a method of safe passage for downstream migrant fall and summer chinook.

The fish and wildlife agencies and tribes represented in the Columbia River Fisheries Council request that you authorize the use of the subject return energy for the purpose of providing spill at mainstem dams that do not have adequate smolt bypass systems such as the John Day Project.

It is recognized that the energy stored at Williston may be spilled and lost, or that the Canadians may opt to purchase the energy. Our request is contingent upon the availability of the return energy.

The cooperation and helpful attitude of your scheduling staff has been appreciated. The extra effort should result in greatly improved fishery resources for future years.

Sincerely,

R. Kahler Martinson

R. Kahler Martinson
Executive Secretary

cc: Brig. Gen. van Loben Sels
NW Power Planning Council Chairman
CRFC Members

xc: Steering Comt.

United States Department of the Interior

BUREAU OF RECLAMATION
~~WATER AND POWER RESOURCES SERVICE~~
PACIFIC NORTHWEST REGION
FEDERAL BUILDING & U.S. COURTHOUSE
BOX 043-550 WEST FORT STREET
BOISE, IDAHO 83724

IN REPLY REFER TO: PN 770
511.

JUN 3 1982

Mr. William R. Wilkerson, Chairman
Columbia River Fisheries Council
Lloyd Building, Suite 1240
700 NE. Multnomah Street
Portland, Oregon 97232

Dear Bill:

This is to acknowledge the actions which were taken in regard to your letter of May 19, 1982, and a call from Terry Hollubetz on the same date to Mr. Brush of our staff, concerning flow releases at Grand Coulee on dissolved gas levels. In cooperation with the Corps of Engineers, the release, although not cut to 155,000 ft^3/s because of flood control, was adjusted down to about 160,000 ft^3/s by May 21 and held at that level to May 25. Spill was held at less than the recommended 25,000 ft^3/s by distribution of spill to other projects within the system. Additional samples for dissolved gas levels are now being taken on the Columbia River 6 miles below Grand Coulee Dam to maintain some record of information.

We will continue to work in assisting the survival of salmon and steelhead; however, because of total system operation, rapid changes in flows at times may not be possible and we would appreciate as much advance notice of requests as possible.

Sincerely yours,

R. W. Lloyd

Regional Director

COLUMBIA RIVER FISHERIES COUNCIL
LLOYD BUILDING . SUITE 1240
700 N.E. MULTNOMAH STREET
PORTLAND, OREGON 97232

(503) 231-2241
FTS 429-2241

OFFICE OF
EXECUTIVE SECRETARY

June 21, 1982

Mr. Peter Johnson
Administrator
Bonneville Power Administration
P.O. Box 3621
Portland, Oregon 97208

Dear Mr. Johnson:

The fisheries agencies and tribes have been pleased with the cooperation your agency has shown in providing special regulation of energy and stream flow to improve survival of this spring's downstream migration of juvenile salmon and steelhead.

It is our hope that the positive actions to restore the anadromous fishery resources of the Columbia Basin will be continued through this summer's juvenile migration and into future years. We anticipate that special flow regulation will be required to protect downstream migrant salmon this summer at the following federal projects:

John Day
The Dalles
Bonneville
Ice Harbor
Lower Monumental

Our requests for spill and sluiceway flows will be based on presence of significant numbers of downstream migrants at these projects, and every effort will be made to increase the compatibility of fish flow requests and energy operations consistent with the objective of improving survivals of juvenile salmon and steelhead passing mainstem projects.

Sincerely,

R. Kahler Martin&
Executive Secretary

cc: CRFC members

RECEIVED

JUN 24 1982

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

OFFICE OF THE ADMINISTRATOR

JUN 2 3 1982

In reply refer to: PSH

Mr. R. Kahler Martinson
Executive Secretary
Columbia River Fisheries Council
Lloyd Building, Suite 1240
700 NE. Multnomah Street
Portland, Oregon 97232

Dear Mr. Martinson:

This is in response to your request of June 3, 1982, to use energy stored at the Williston Project for summer spill at the John Day Project. As you stated, this energy may be purchased by B.C. Hydro and Power Authority or spilled prior to the need for summer spill at John Day: therefore, it cannot be relied on to provide your needs.

If, in fact, energy is recovered from the storage operation, it will be available for service of Federal System loads including nonfirm sales. BPA is willing to reduce nonfirm sales this year to support authorized spill requested through the Corps of Engineers, regardless of the status of the energy stored in Williston. We believe this commitment provides a much broader basis for establishing levels of summer spill. We would expect spill to occur only when migrants are present in sufficient numbers as has been the rule in the past.

The details of monitoring the presence of juveniles and requesting the spill should be arranged with the Corps of Engineers. We will continue to provide assistance to achieve our mutual goals of a safe downstream fish migration and an efficient power operation.

Sincerely,

Peter T. Johnson

Administrator

cc:
Brig. Gen. van Loben Sels, Corps of Engineers
NW Power Planning Council Chairman

COLUMBIA RIVER FISHERIES COUNCIL
LLOYD BUILDING . SUITE 1240
700 N. E. MULTNOMAH STREET
PORTLAND, OREGON 97232

(503) 231-2241
FTS 429-2241

OFFICE OF
EXECUTIVE SECRETARY

June 25, 1982

Memorandum

To: Files

From: Terry Holubetz

Subject: Special Request to Corps - Defer Maximizing Transportation

The persistence of the Corps to maintain loading at collector dams has resulted in transfering excessive spill to projects that are creating high levels of dissolved gases.

The amount of spill anticipated for this weekend requires that the objective for controlling dissolved gases override the objective for maximizing transportation.

The attached letter was developed to obtain the desired spread of spill to collector dams.

COLUMBIA RIVER FISHERIES COUNCIL
LLOYD BUILDING . SUITE 1240
700 N. E. MULTNOMAH STREET
PORTLAND, OREGON 97232

(503) 231-2241
FTS 429-2241

OFFICE OF
EXECUTIVE SECRETARY

June 25, 1982

Brigadier General James W. van Loben Sels
Division Engineer
North Pacific Division
Corps of Engineers
P.O. Box 2870
Portland, Oregon 97208

Dear General van Loben Sels:

The Columbia River Fisheries Council respectfully requests your cooperation in a special effort to control dissolved gases in the Columbia and Snake Rivers over the weekend of June 26 and 27.

It is recommended that the objective of maximizing transportation be deferred for the next two days, and the attached set of spill objectives be implemented to reduce dissolved gas levels to the greatest degree possible.

Sincerely,

K. Kahler Martinson

Kahler Martinson
Executive Secretary

Attachment

Spill Priority

Submitted on June 25, 1982

Priority	Project	Requested Amount of Spill
1	John Day	150 KCFS
2	The Dalles	180 KCFS
3	Ice Harbor	60 KCFS
4	Lower Monumental	100 KCFS**
5	Priest Rapids	80 KCFS
6	Wanapum	60 KCFS
7	Washington Water Power	350 MW Equiv.
8	Idaho Power	400 MW Equiv.
9	Rock Island	50 KCFS
10	Rocky Reach	30 KCFS
11	Priest Rapids	120 KCFS
12	Wanapum	100 KCFS*
13	Rock Island	100 KCFS*
14	Rocky Reach	80 KCFS*
15	Wells	80 KCFS*
16	The Dalles	No Limit
17	Priest Rapids	No Limit
18	Chief Joseph	25 KCFS
19	McNary	No Limit
20	Lower Granite	150 KCFS*
21	Little Goose	80 KCFS*
22	Grand Coulee	25 KCFS*
23	Chief Joseph	50 KCFS*
24	Bonneville	No Limit
25	John Day	200 KCFS*
26	Ice Harbor	100 KCFS*
27	Grand Coulee	60 KCFS

*Federal energy or spill should be allocated in a matter to prevent exceeding these project spill levels.

**Lower Monumental - 0500 to 2200 hours - up to 100 KCFS spill
2200 to 0500 hours - 100 MW minimum generation
No limit on soil1

Table 3

CRFC RECOMMENDATIONS

FOR

SPILL AND SLUICEWAY OPERATION

July 15 to September 15, 1982

PROJECT	VOLUME	HOURS	CRITERIA FOR IMPLEMENTING
John Day Spill	80,000 cfs or 50% of total flow, whichever is greater	6 to 8	When passage estimates based on NMFS sampling exceed 30,000 fish per day
The Dalles Sluiceway	3,600 to 4,000 cfs	0500 to 2100	When fish are present
The Dalles Spill	25% of total flow	1500 to 2400	When passage estimates for John Day exceed 30,000 fish for the previous day
Ice Harbor Sluiceway	2,000 cfs	21	When fish are present
Lower Monumental Spill	50% of total flow	6	When total catches of salmonids exceed 800 fish for the previous day
Bonneville Sluiceway	7A open completely 10C open to top of orifices (approx. 750 cfs)	24	When fish are present

C...

COLUMBIA RIVER FISHERIES COUNCIL
LLOYD BUILDING • SUITE 1240
700 N. E. MULTNOMAH STREET
PORTLAND, OREGON 97232

(503) 231-2241
FTS 429-2241

Office of
Executive Secretary

July 23, 1982

Memorandum

To: Jim Cayanus

From: Terry Holubetz

Subject: Spill Priorities

The priorities for allocation of forced spill are listed below:

Priority	Project	Requested Amount of Spill
1	John Day	100,000
2	The Dalles	60,000
3	Priest Rapids	40,000
4	Wanapum	30,000
5	Bonneville	100,000
6	Rock Island	50,000
7	Rocky Reach	30,000

This request is subordinate to our request for spill and sluiceway flows submitted to the Corps and BPA on July 14, 1982. Some of the CRFC members are disturbed about the lack of spill at The Dalles Dam over the last two evenings. Your assistance in providing protection from turbine mortality for juvenile migrants will he appreciated.

RECEIVED

NOV 8 - 1982

DEPARTMENT OF THE ARMY
NORTH PACIFIC DIVISION CORPS OF ENGINEERS
P.O. BOX 2870
PORTLAND OREGON 97208

NPDEN-WM

4 November 1982

S. Timothy Wapato
Executive Director
Columbia River Inter-Tribal Fish Commission
2705 E. Burnside
Portland, OR 97232

Dear Mr. Wapato:

This is in response to your 7 October 1982 letter concerning tribal concern over protection provided for the 1982 summer migrants at Corps projects. Our projects were operated for the summer outmigration as outlined in my 26 July 1982 letter to the Columbia River Fisheries Council. Sonar monitoring at John Day was extended two weeks longer than last year, through 24 August, and the Corps biologist was authorized to spill up to 80,000 cfs when significant numbers of fish were present (400-500 fish per hour expanded sonar counts per monitored units). This sonar index correlated well with NMFS unit 3 airlift index threshold of 30,000 daily passage. John Day unit 3 failed and was out of service from 19 July through 3 August and NMFS attempted to index passage by dipping in unit 2 gatewells. Unfortunately, the unit 2 and sonar indices did not correlate well.

The Dalles sluiceway was reactivated from 1-15 October to provide protection for the substantial increase in summer migrants that occurred in late September and early October.

I look forward to working with you and the other fishery agencies with the expectation that the Northwest Power Planning Council fish and wildlife program will help us reach a coordinated effort to protect our valuable Columbia Basin resouroes.

Sincerely,

SIGNED

JAMES W. VAN LOBEN SELS
Brigadier General, USA
Division Engineer

CF:
Power Planning Council
BPA
CRFC

AC. Advisors
Lionel Boyer
CBFTC members

FOR YOUR INFORMATION
COLUMBIA RIVER FISHERIES COUNCIL

DEPARTMENT OF THE ARMY
NORTH PACIFIC DIVISION, CORPS OF ENGINEERS
P.O. BOX 2870
PORTLAND, OREGON 97208

NPDEN-WM

26 March 1982

Mr. William R. Wilkerson, Chairman
Columbia River Fisheries Council
Lloyd Bldg., Suite 250
700 NE Multnomah Street
Portland, OR 97232

RECEIVED

MAR 3 0 1982

Dear Mr. Wilkerson:

I am writing, as promised in my letter of 5 February 1982, to advise you of our plans for protecting juvenile salmonids as they migrate to sea during the spring of 1982. The 1 March forecast of January-July runoff indicates a volume of about 126 million acre-feet (115% of normal) in the Columbia River Basin above The Dalles, Oregon.

Based on this forecast, and assuming average subsequent weather conditions, our studies indicate a greater than 95 percent confidence level of providing optimum fishery flows in the Columbia River. However, flows in the Snake River at Lower Granite are highly dependent on natural runoff conditions as reservoir storage upstream of the Lower Granite Project is Limited. Therefore, while minimum recommended flows will probably be available, it is doubtful that optimum flow levels can be achieved for this full specified period. We will work with you, however, to shape the available flow to gain maximum advantage for the migrating juvenile fish.

In addition to providing flow assistance, we are planning to collect and transport as many juveniles as possible at Lower Granite, Little Goose, and McNary Projects. ALL units are screened at Lower Granite and Little Goose Dams this year and at McNary all but one unit will be screened. A fourth barge will be in service this year which should reduce the holding times at each project.

We will have sonar monitors at Lower Monumental and John Day and spill will be provided when concentrations of juveniles are present. The spill patterns and quantities at Lower Monumental Dam will be similar to last year's successful operation. In view of the high runoff expected this year, we will strive to provide spill for juvenile passage at John Day that will be near 50 percent of the total project discharge from 2100 hours through at Least midnight during the spring outmigration as requested by the fishery agencies.

The sluiceway at Ice Harbor has been modified and four new automated gates will provide passage for juveniles from the forebay. our Walls Walla District has retained a contractor to evaluate the effectiveness of the Ice Harbor sluiceway passage and we are prepared to provide special spills if the sluiceway does not effectively pass juveniles.

The Dalles sluiceway will be operated similar to past years to provide juvenile passage. At the Bonneville second powerhouse, all turbines will be screened when they are placed in service. The ice and trash sluiceway will be operated to provide juvenile passage at the first powerhouse.

While the above normal runoff forecast for 1982 will provide good flow conditions for the juveniles, potential excessive forced spill throughout the system may produce high Levels of gas supersaturation. We plan to monitor dissolved gas levels at McNary, John Day and The Dalles Dams, and when forced spill is required, we will try to distribute it throughout the system so as to reduce the saturation Levels as much as possible.

We intend to work closely with the Committee on Fiahery Operation, Columbia River Fishery Council and Columbia River Inter-Tribal Fish Commission during the spring migration and will seek to provide the best possible protection to the fish stocks consistent with system capabilities.

Sincerely,

JAMES W. VAN LOBEN SELS
Brigadier General, USA
Division Engineer

Copy furnished:
Chairman, Columbia River Inter-Tribal Fish Commission
Regional Director, National Marine Fisheries Service
Regional Director, U.S. Fish and Wildlife Service
Director, Oregon Departmentof Fish and Wildlife
Director, Washington Department of Fisheries
Director, Washington Department of Game
Director, Idaho Department of Fish and Game
Administrator, Bonneville Power Administration
Assistant Regional Director, Bureau of Reclamation
Chairman, Federal Energy Regulatory Commission
Manager, Grant County Public Utility District
Manager, Chelan County Public Utility District
Manager, Douglas County Public Utility District

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

In reply refer to: PSH

OFFICE OF THE ADMINISTRATOR RECEIVED

MAR 31 1982 APR 1. 1982

Mr. William R. Wilkerson, Chairman
Columbia River Fisheries Council
Lloyd Building, Suite 1240
700 Northeast Multnomah Street
Portland, Oregon 97232

Dear Mr. Wilkerson:

This letter acknowledges your request that Bonneville Power Administration respond in writing to the CRFC regarding the use of weekly average flows rather than the use of the fishery agencies' recommended daily average flows during the spring outmigration period.

The added flexibility afforded by the use of weekly average flows allows the hydroelectric system to more efficiently match its production with energy loads. Recent studies have shown that in past years, the use of weekly average flows has saved BPA ratepayers over $1 million per year. Also, it is our understanding that studies by the National Marine Fisheries Service show no adverse effects to smolt migration from weekly average flows and, in fact, weekly average flows appear to enhance the migration of adult salmon and steelhead.

This letter confirms discussions our staff has had with your staff during the recent COFO Workgroup meetings and requests that you modify your recommendations as stated in the 1982 Detailed Fishery Operating Plan to allow weekly average flows during the 1982 fish flow operation. BPA looks forward to an early response to this letter.

Sincerely,

ACTING Administrator

cc:
Brig. General J. W. "an Loben Sels, COE

FOR YOUR INFORMATION
COLUMBIA RIVER FISHERIES COUNCIL

xc: Steering Committee
CBFTC
Advisors

RECEIVED

APR 6 1982

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

OFFICE OF THE ADMINISTRATOR

In reply refer to: PSH

APR 5 1982

Mr. William R. Wilkerson, Chairman
Columbia River Fisheries Council
Lloyd Building, Suite 1240
700 Northeast Multnomah Street
Portland, Oregon 97232

Dear Mr. Wilkerson:

We are writing to advise you of Federal water management agencies' plans for providing protection for juvenile salmonids during the 1982 spring outmigration. The March 1 January-July volume runoff forecast at The Dalles of 126 million acre-feet (115 percent of normal) indicates enough wafer to meet optimum fishery flow requirements at Priest Rapids and The Dalles Dams. If the volume forecast of 37.6 million acre-feet (119 percent of normal) in the Snake Basin verifies, optimum fishery flows can also be provided at Lower Granite. However since there is limited storage and regulation capability in the Snake Basin, the natural runoff will be the determining factor in the timing and the magnitude of the flows. Also, at Lower Granite Dam, flows of 130,000 cfs will be provided to assist in the trapping of juvenile migrants. This flow represents a slight reduction of the 140,000 cfs recommended optimum fishery flows which cause spill since the maximum turbine capacity is 130,000 cfs.

Details for spilling water and for trapping and hauling juvenile migrants at the lower Snake and lower Columbia plants are discussed in a similar letter to you from the Corps of Engineers. These plans have been developed in consultation with Bonneville Power Administration, and we are in agreement with them.

With regard to 1982 summer and fall recommended flows, it is impossible to commit to any flow augmentation too far into the future since reservoir levels and water supply conditions for the summer season are unknown at this time. We will evaluate the forecasted summer runoff and the reservoir conditions in mid-June and apprise you of the situation then.

Since we have a 1982 forecasted runoff well above normal, we intend to provide the modified fishery optimum flows through June 15. Of course, we evaluate the water supply forecast on a continuing basis as the season progresses and make any adjustments necessary. Bonneville Power Administration will continue to work through the Committee on Fishery Operations (COFO) to ensure a successful fishery operation.

Sincerely,

ACTING Administrator

CC:
General J. W. van Loben Sels, Corps of Engineers
William Lloyd, U. S. Bureau of Reclamation
Jerry Conley, Idaho Department of Fish and Game
Harold Culpus, Columbia River Inter-Tribal Fish Commission
John Donaldson, Oregon Department of Fish & Wildlife
H. A. Larkins, National Marine Fisheries Service
Frank Lockard, Washington Department of Game
Richard Myshak, U.S. Fish & Wildlife Service
Rolland Schmitten, Washington Department of Fisheries
Gerald Copp, Chelan County PUD
Fred Lieberg, Douglas County PUD
Larry Peterson, Grant County PUD

United States Department of the Interior

BUREAU OF RECLAMATION
PACIFIC NORTHWEST REGION
FEDERAL BUILDING & U.S. COURTHOUSE
BOX 043 - 550 WEST FORT STREET
BOISE, IDAHO 83724 - 0430

FOR YOUR INFORMATION
COLUMBIA RIVER FISHERIES COUNCIL
APR 15

xc: CRFC
Steering Comt
CBFTC

IN REPLY REFER TO: PN 770
565.

APR 5 1982

Mr. William R. Wilkerson, Chairman
Columbia River Fisheries Council
Lloyd Building, Suite 250
700 NE. Multnomah St.
Portland, Oregon 97232

Dear Mr. Wilkerson:

This is a followup to our letter of February 3, 1982, in which we stated that with the runoff volume forecast at that time we could provide the minimum flows in the mid-Columbia, and would study providing optimum flow based on future forecast as the season progressed.

The March 1 volume forecast at The Dalles is now indicated to be about 126 million acre-feet or 115 percent of normal. Based on this forecast, the Bureau should be able to provide the optimum flows in the mid and lower Columbia River. This is based on normal subsequent weather conditions. If the weather should turn dry during April and May, we will make every effort to provide higher than minimum for a short time. This would be coordinated through the fishery coordination and COFO.

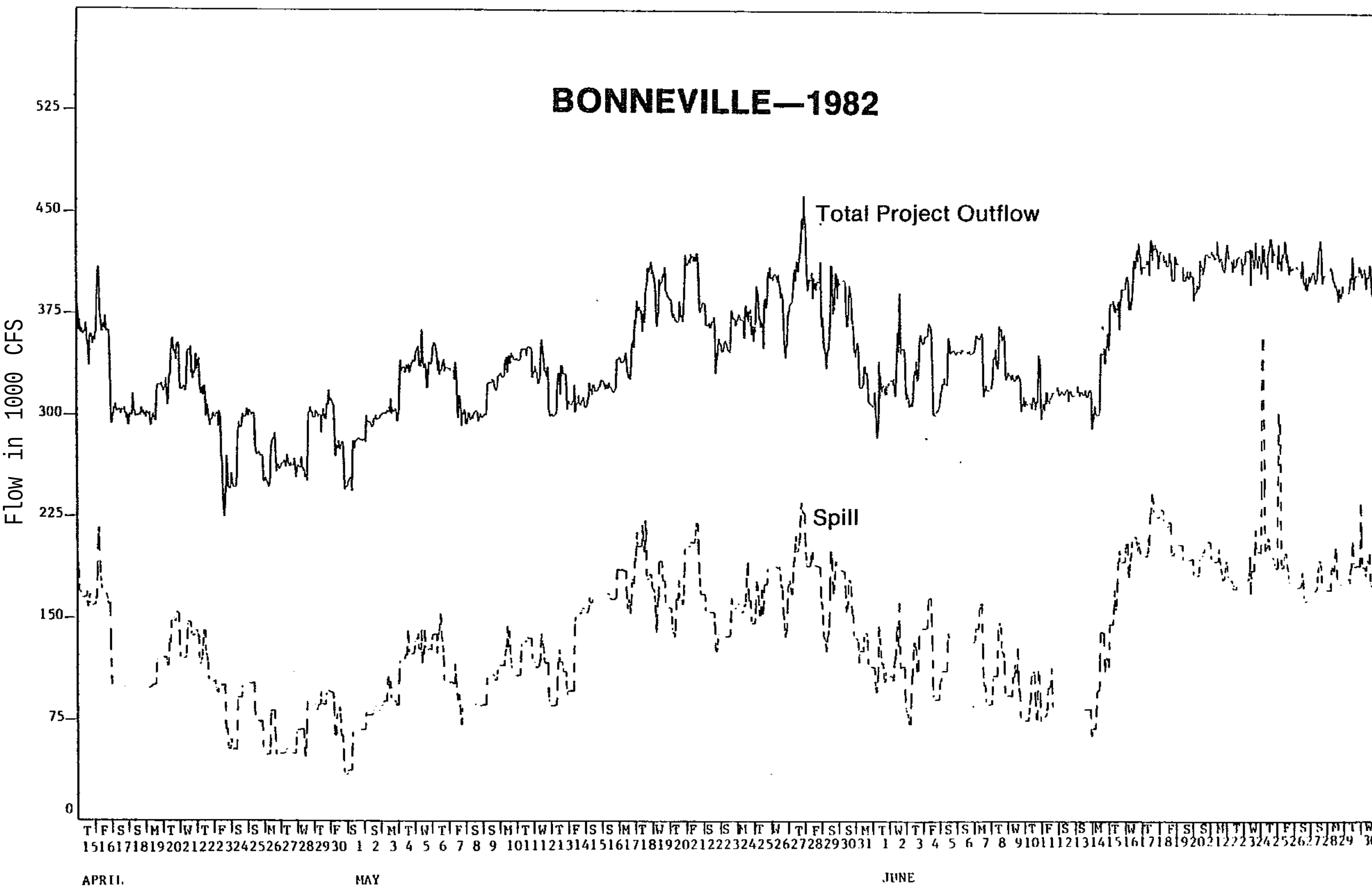
The Bureau will continue to work through COFO to provide protection to the spring outmigration consistent with system capabilities. We look forward to being a part of the total effort to assure the success of the 1982 fish operation.

Sincerely yours,

L. W. Lloyd

Regional Director

BON



Hourly Outflow and Spillway

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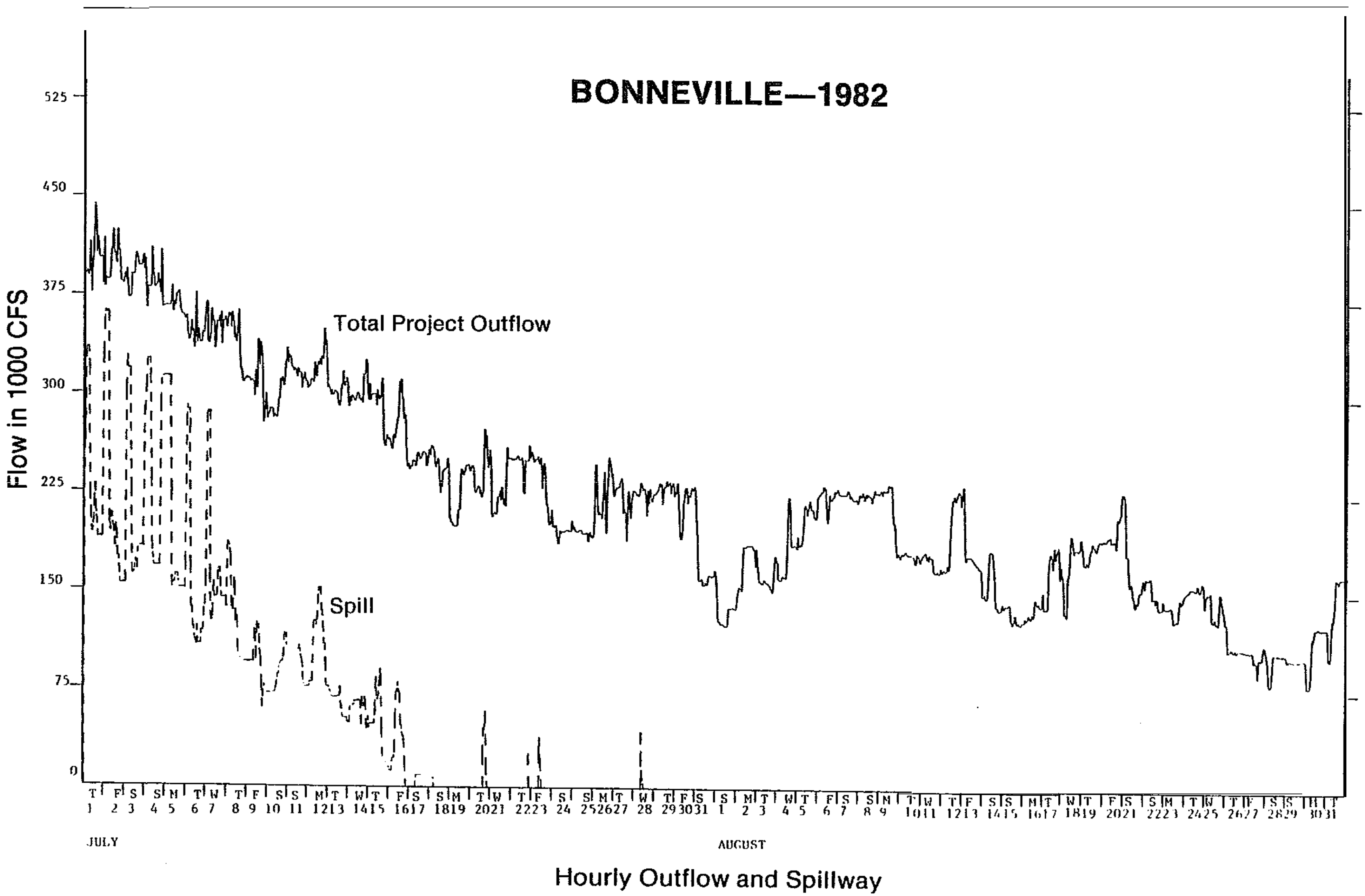

BONNEVILLE—1982
Flow in 1000 CFS
525
450
375
300
225
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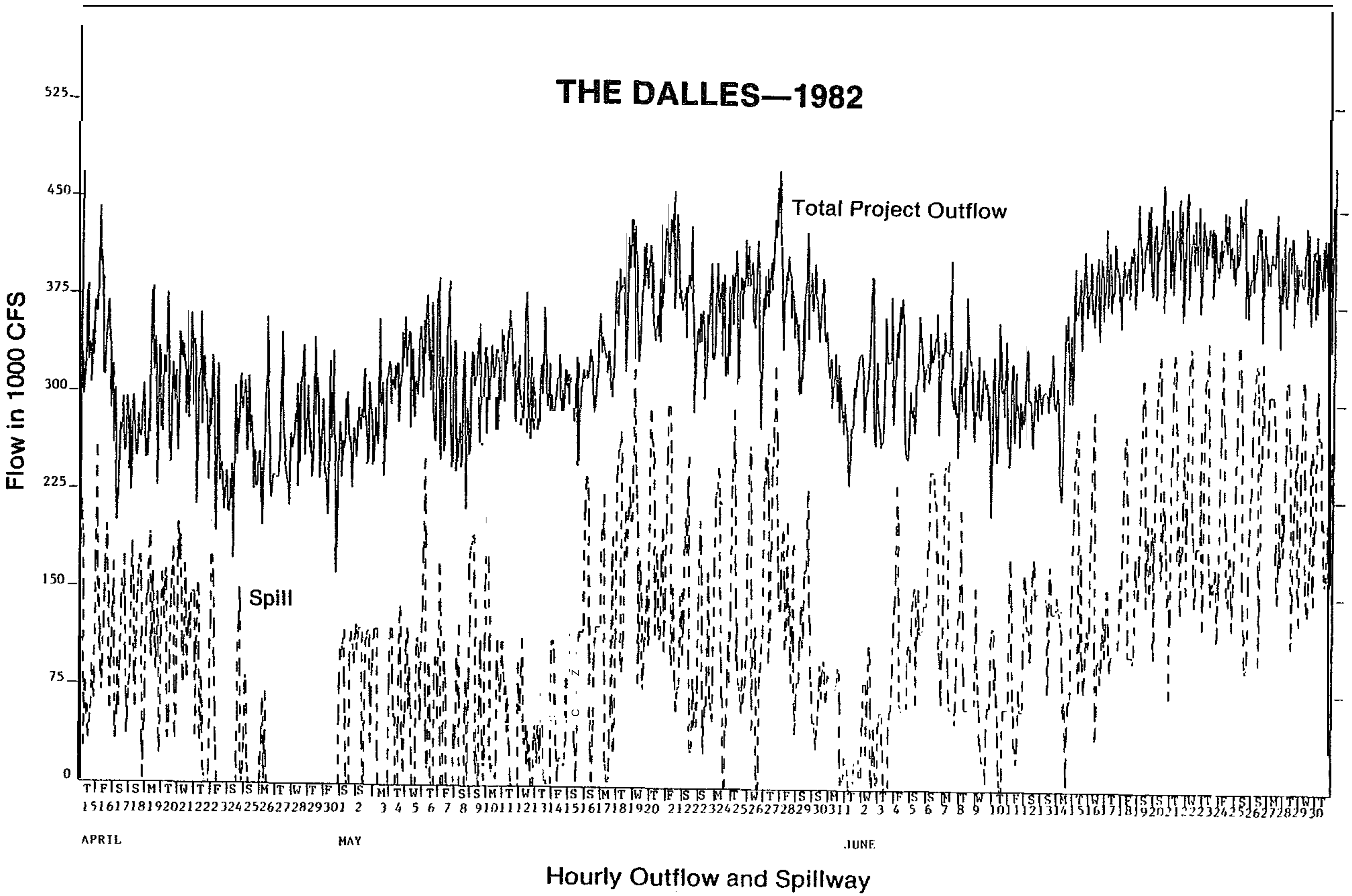
75
0
Total Project Outflow
Spill
JULY
AUGUST
Hourly Outflow and Spillway

TDA


THE DALLES—1982
Total Project Outflow
Spill
Flow in 1000 CFS
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450
375
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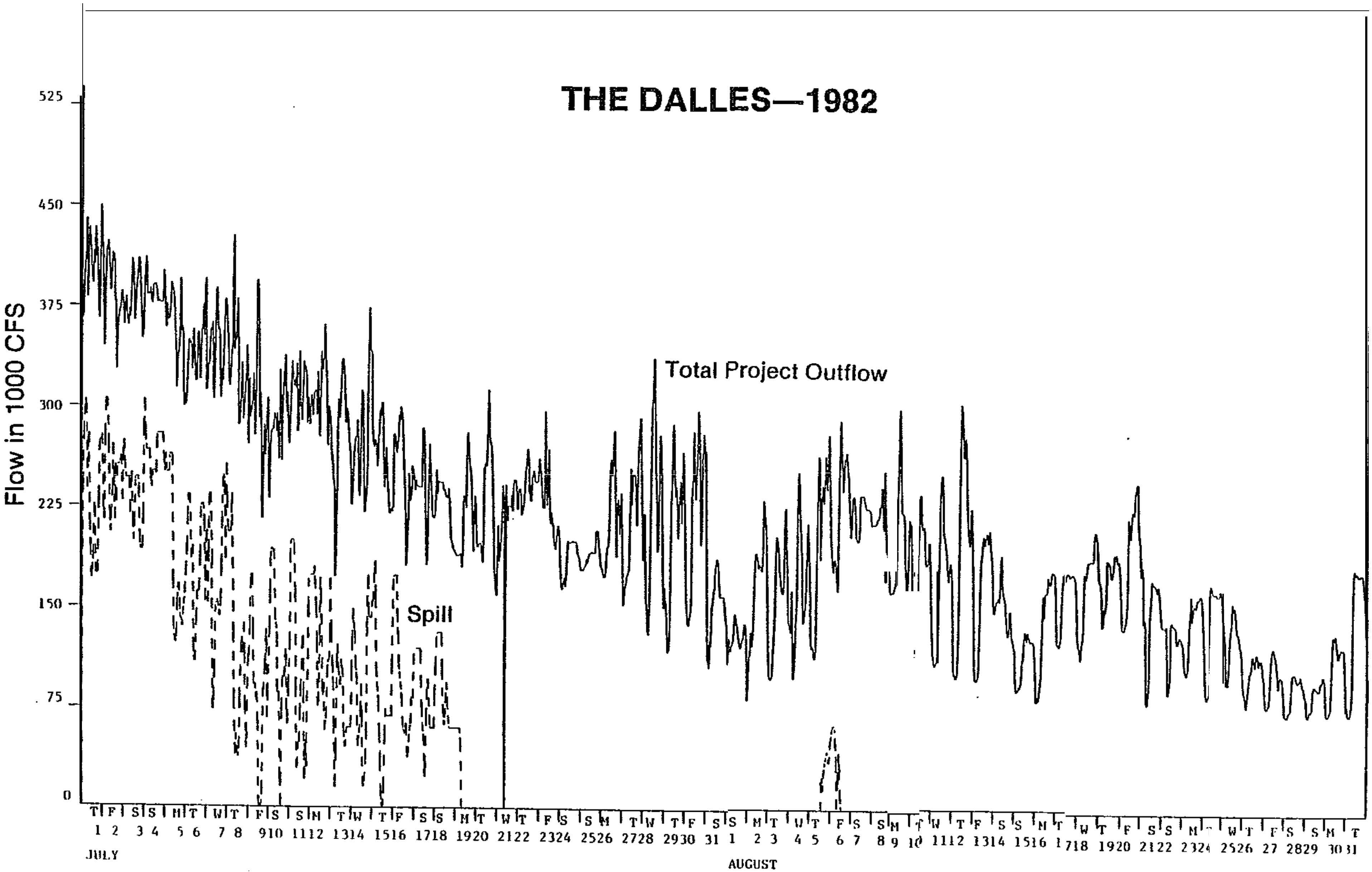
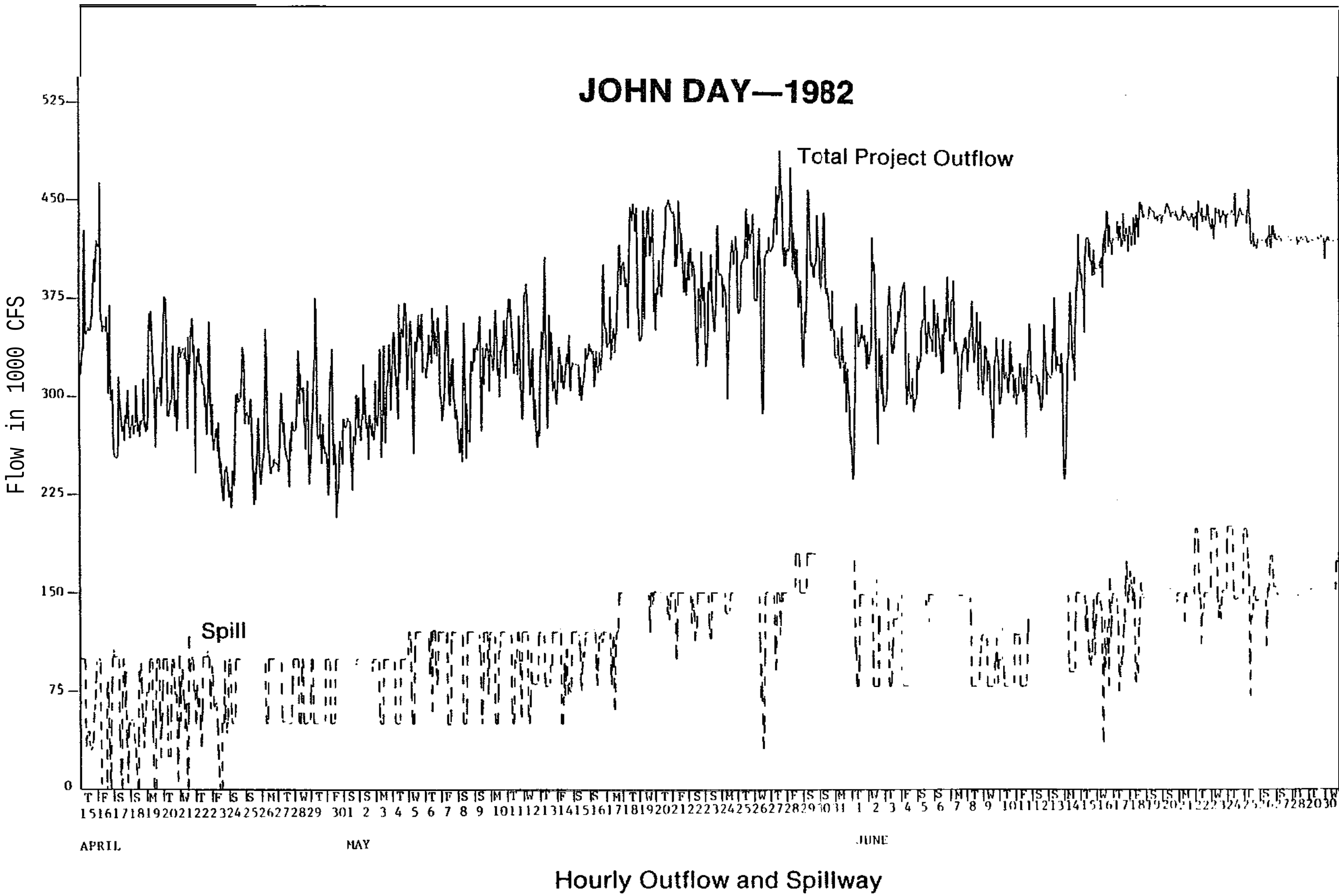
75
0
APRIL
MAY
JUNE
Hourly Outflow and Spillway

TDA



Hourly Outflow and Spillway


JOHN DAY—1982
Total Project Outflow
Spill
Flow in 1000 CFS
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450
375
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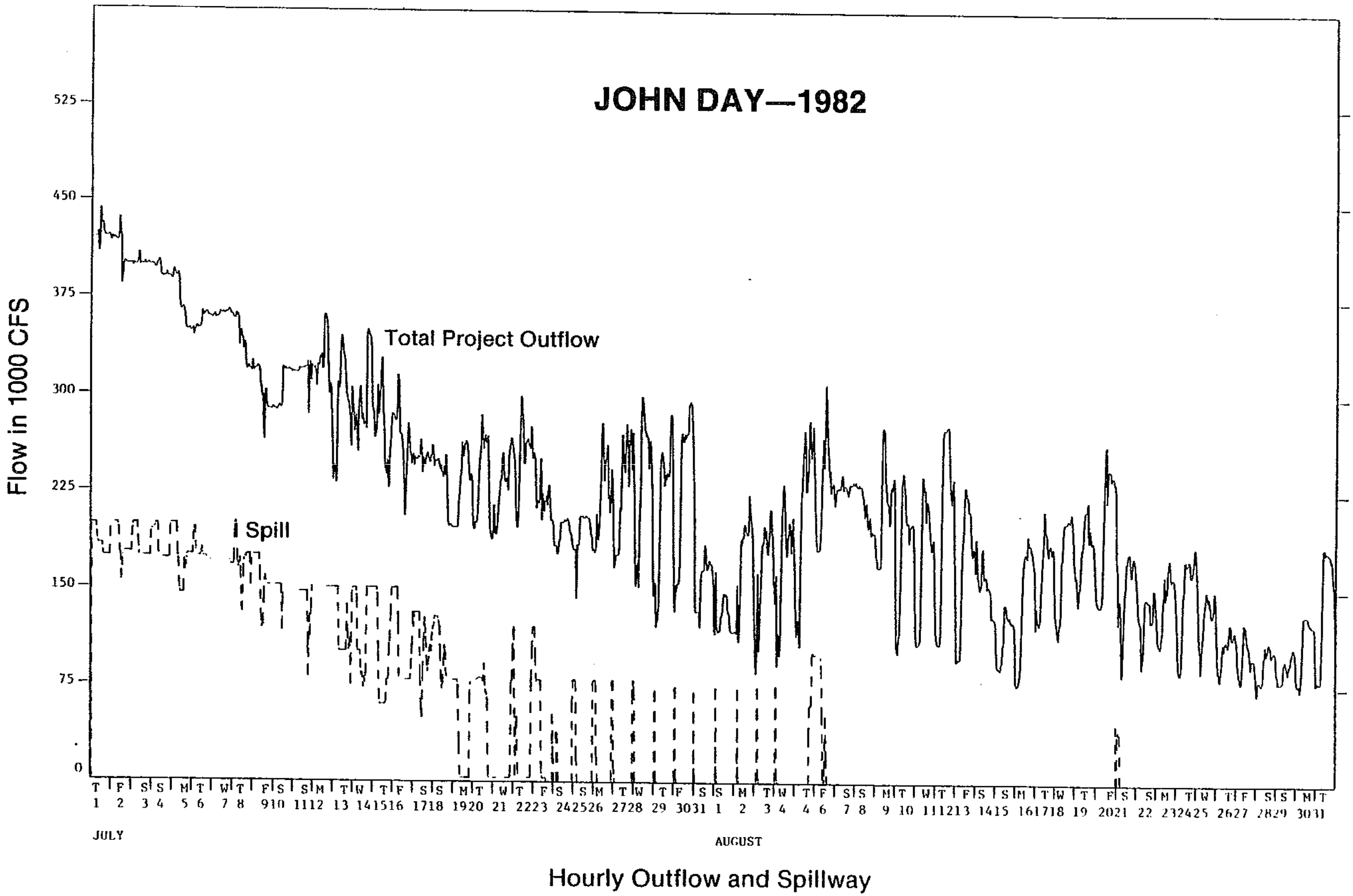
APRIL
MAY
JUNE
Hourly Outflow and Spillway

JD



JOHN DAY—1982
Total Project Outflow
Spill
Flow in 1000 CFS
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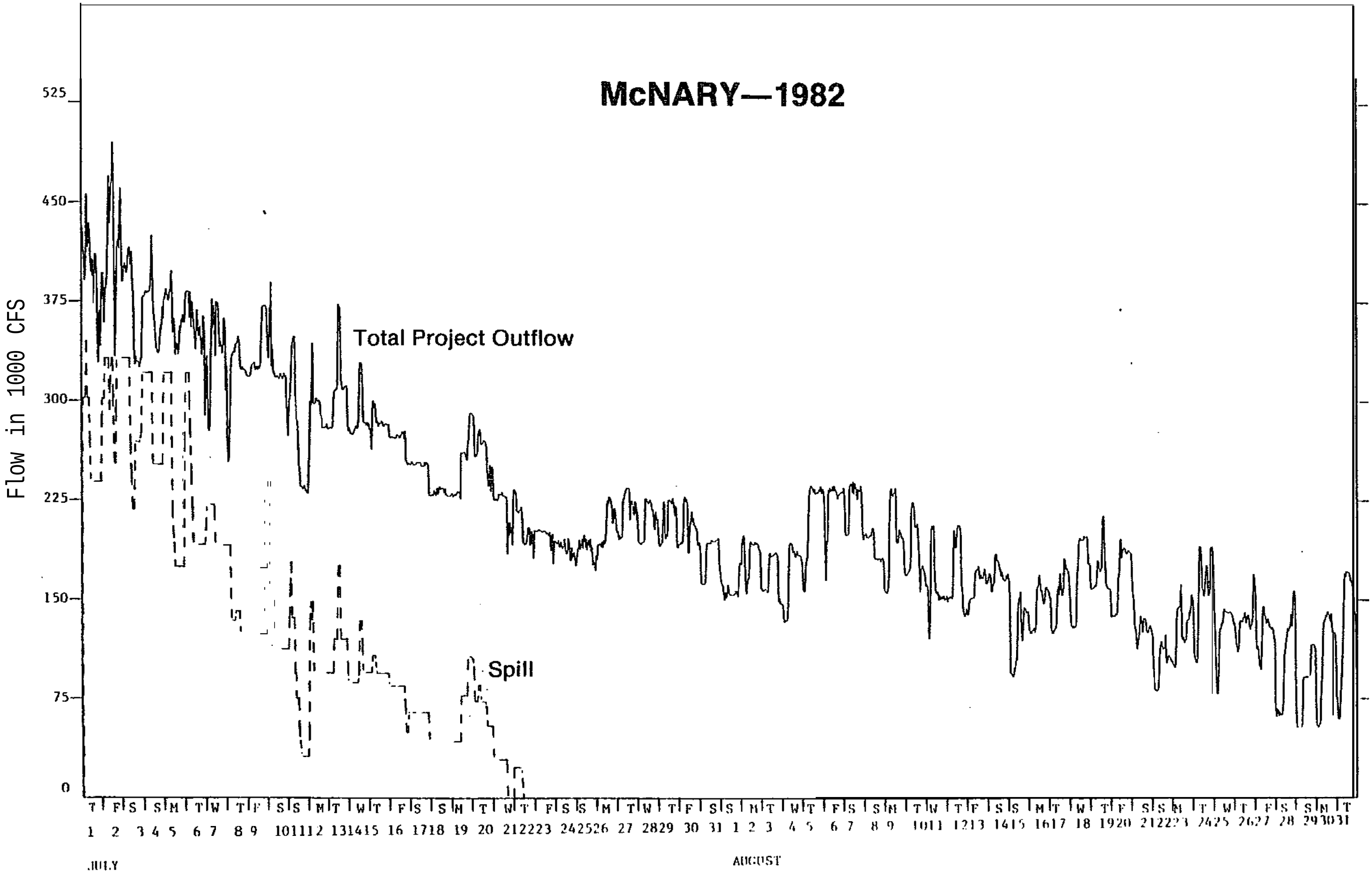
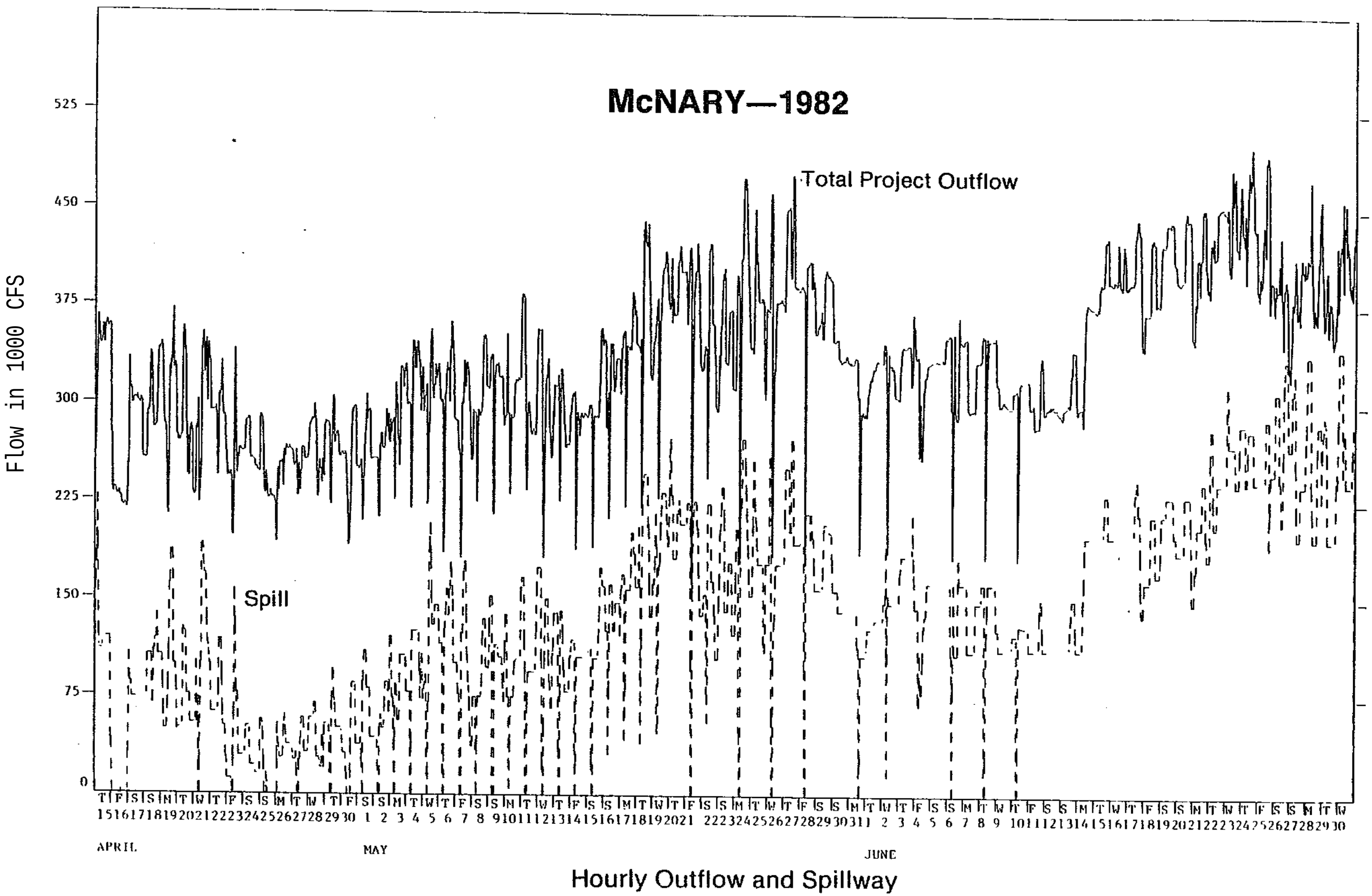
JULY
AUGUST
Hourly Outflow and Spillway



Hourly Outflow and Spillway

MCN



McNARY—1982
Total Project Outflow
Spill
Flow in 1000 CFS
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450
375
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225
150
75
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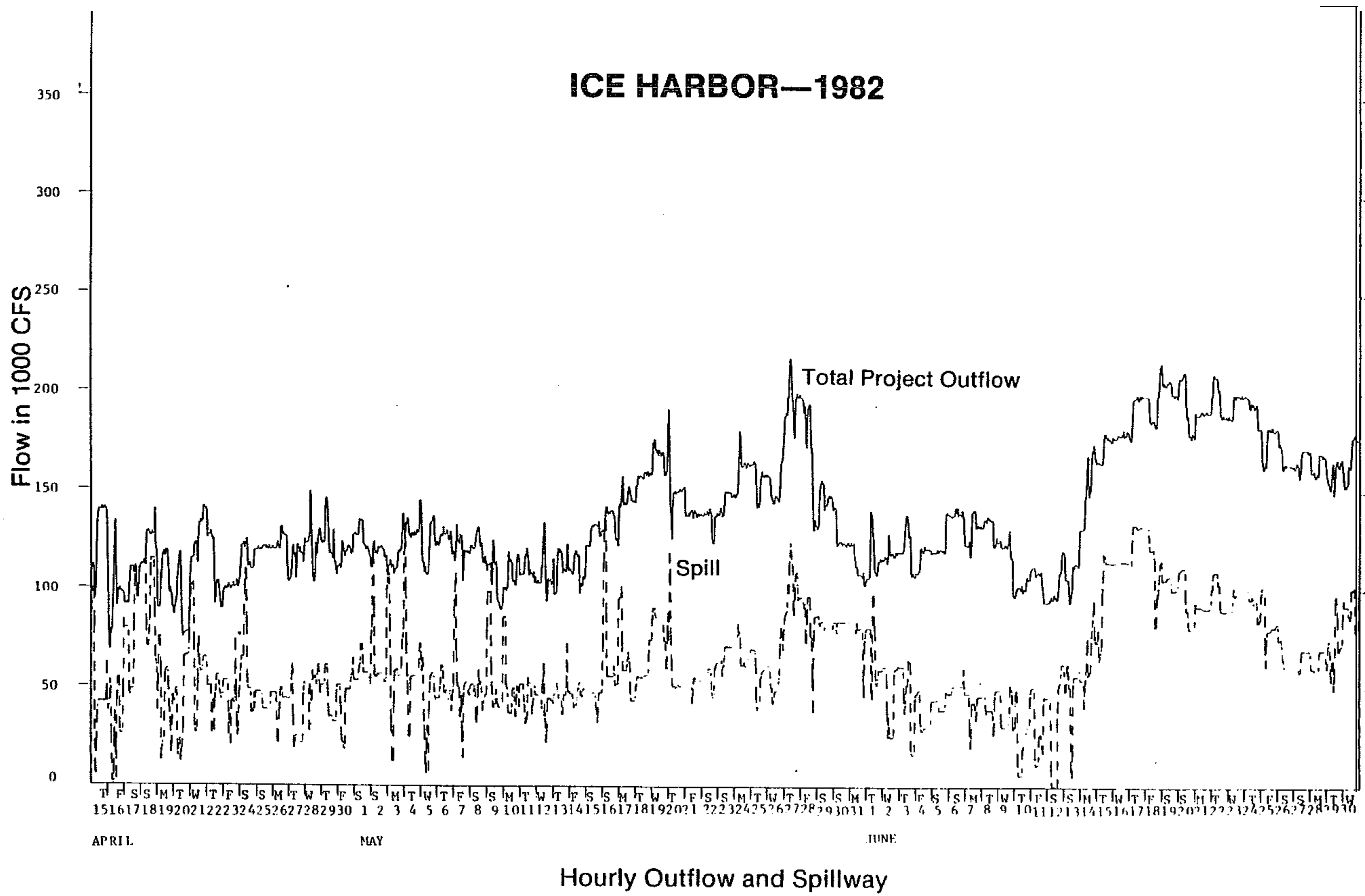
APRIL
MAY
JUNE
Hourly Outflow and Spillway



ICE HARBOR—1982
Total Project Outflow
Spill
Flow in 1000 CFS
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APRIL
MAY
JUNE
Hourly Outflow and Spillway

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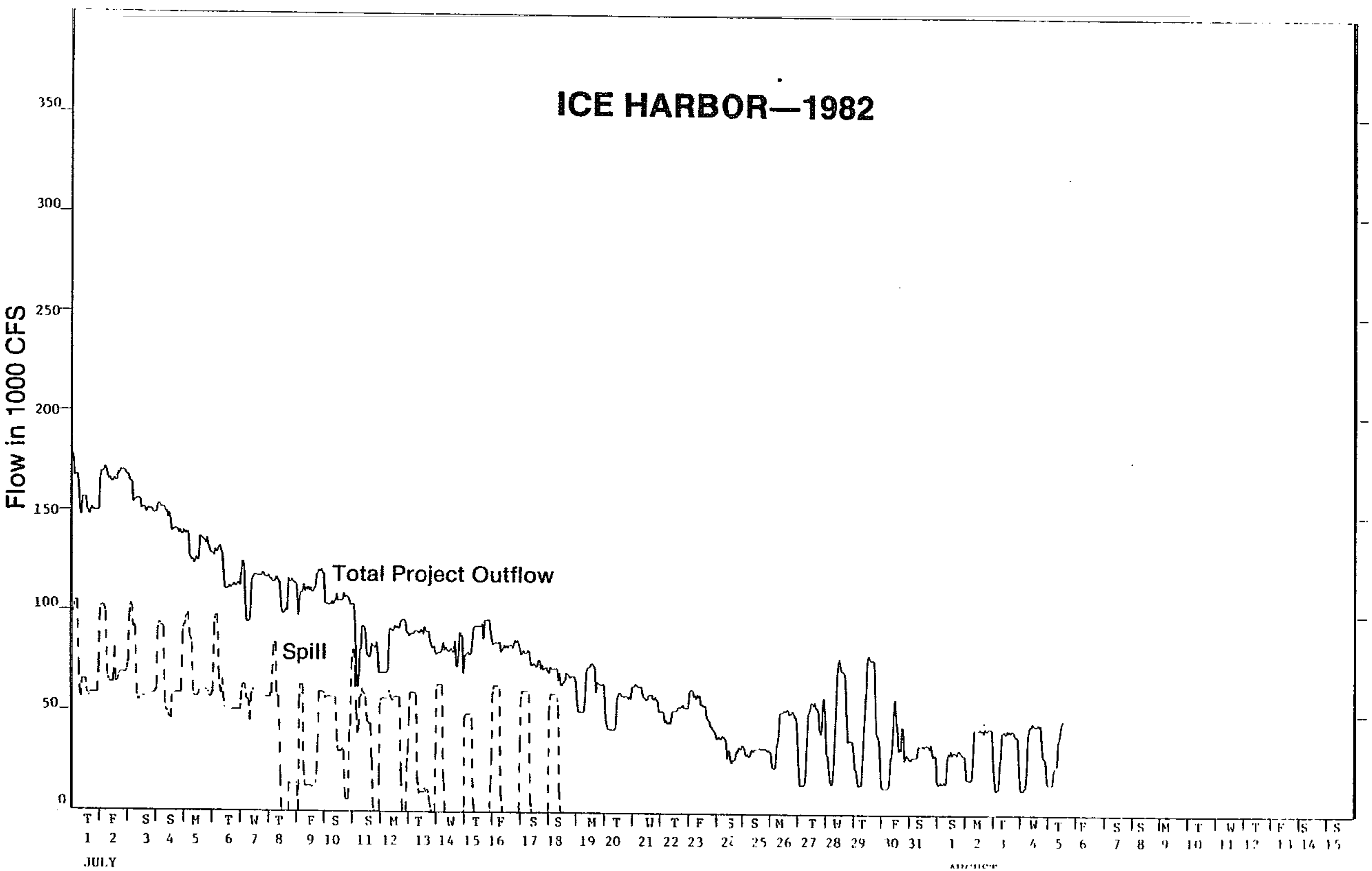

Hourly Outflow and Spillway

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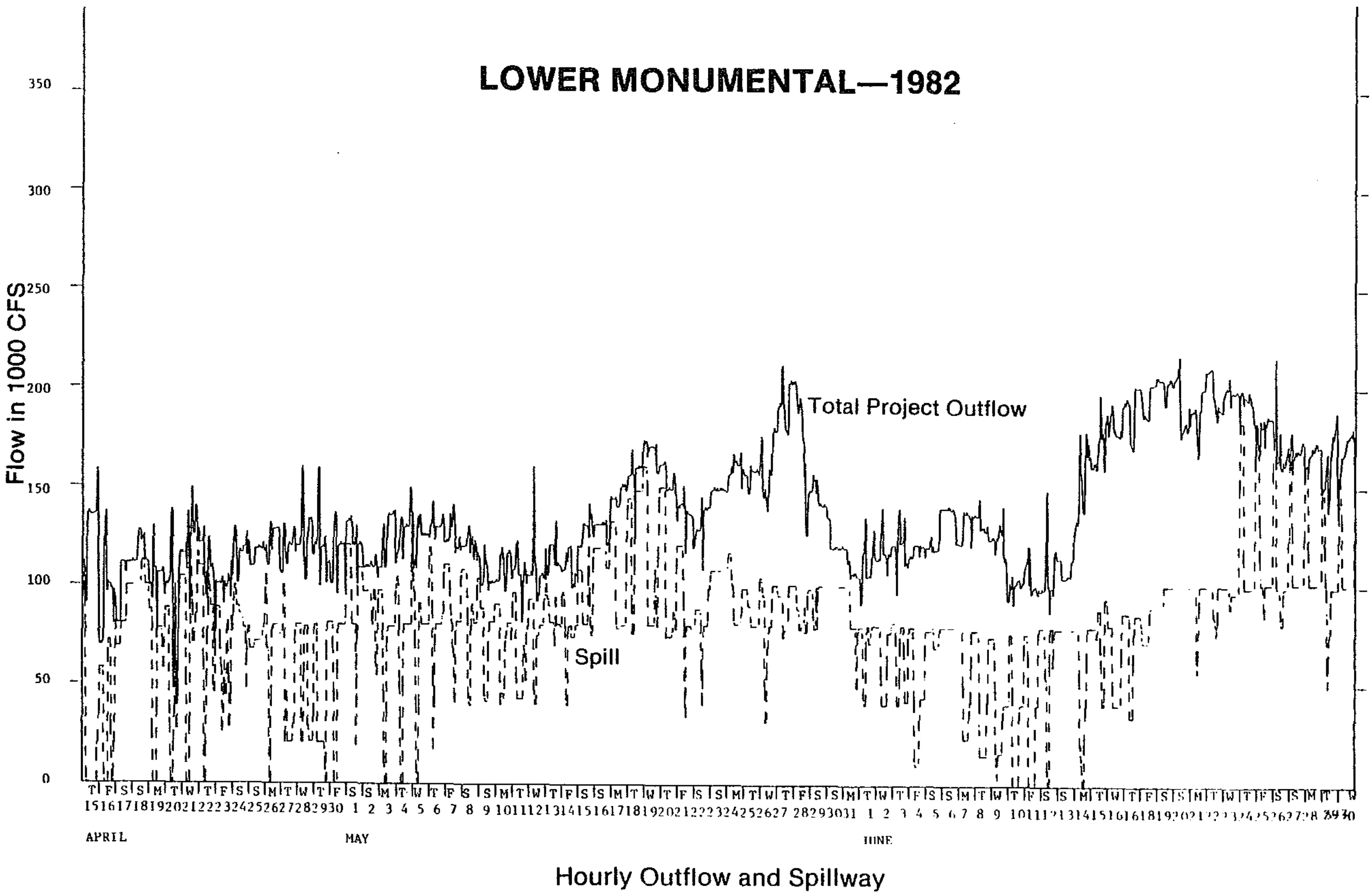

LOWER MONUMENTAL—1982
Total Project Outflow
Spill
Flow in 1000 CFS
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APRIL
MAY
JUNE
Hourly Outflow and Spillway

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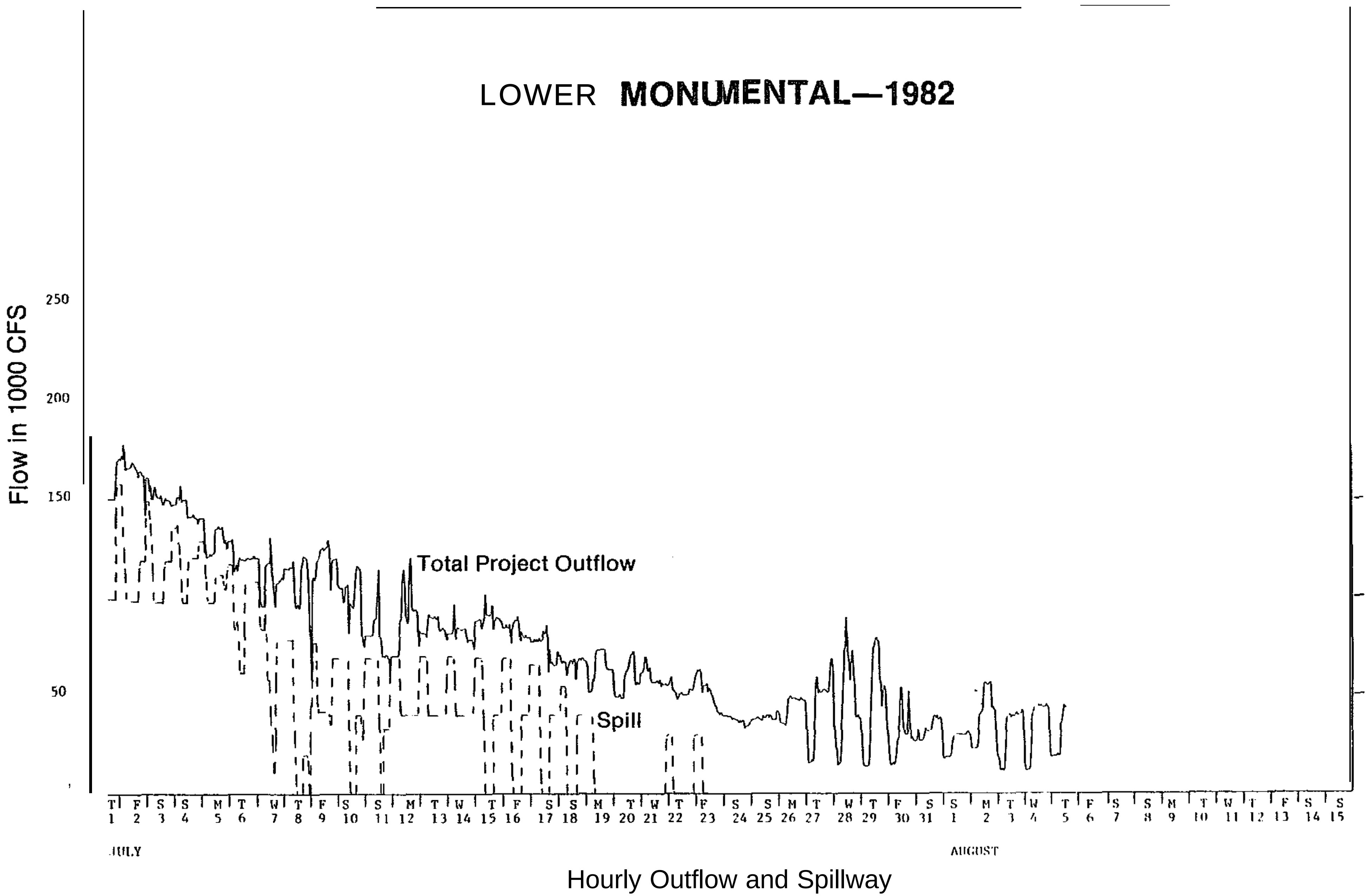
LOWER MONUMENTAL—1982
Flow in 1000 CFS
250
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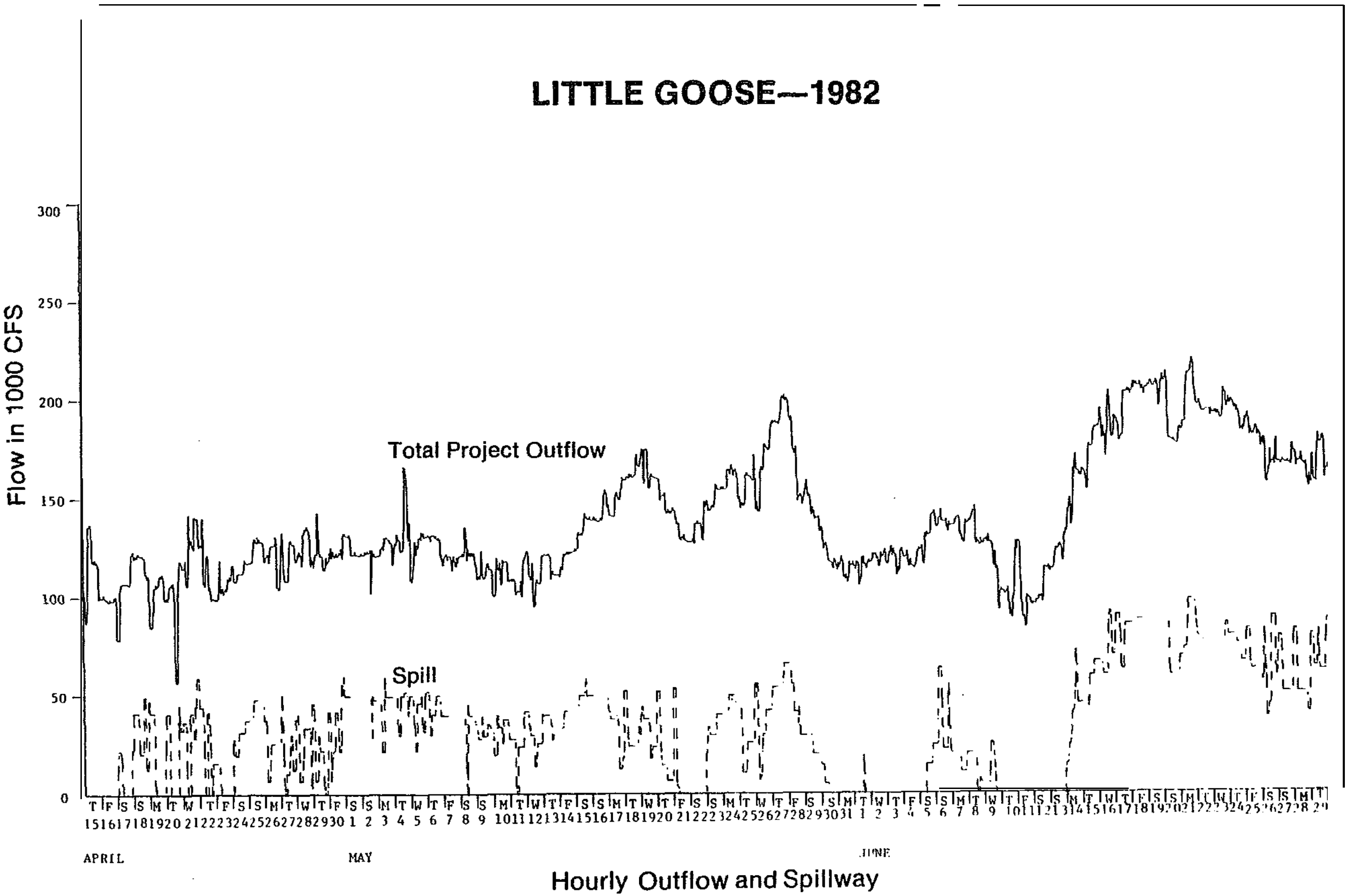
Total Project Outflow
Spill
JULY
AUGUST
Hourly Outflow and Spillway



LITTLE GOOSE—1982
Flow in 1000 CFS
300
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Total Project Outflow
Spill
APRIL
MAY
JUNE
Hourly Outflow and Spillway

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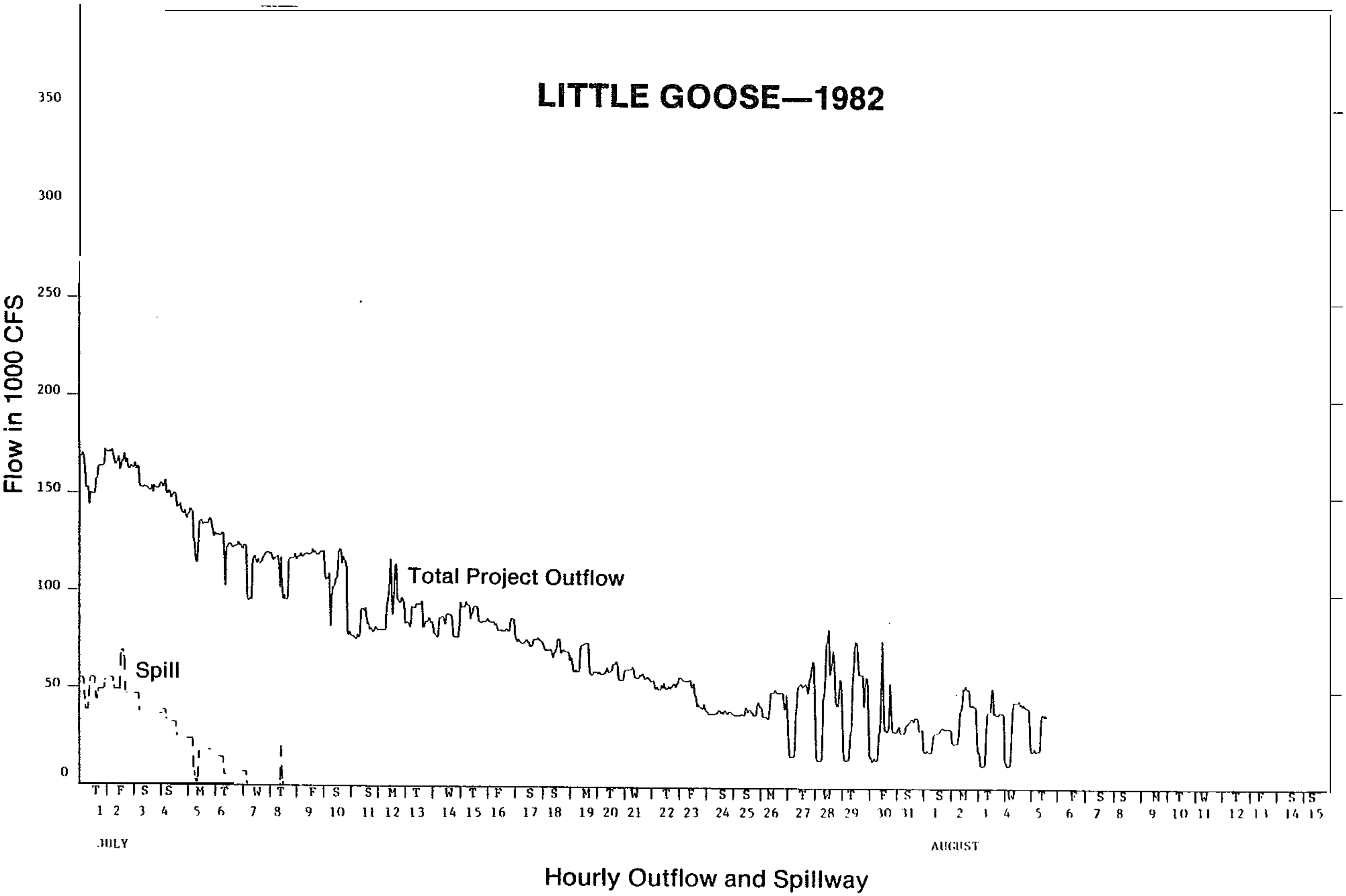

LITTLE GOOSE—1982
Flow in 1000 CFS
350
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Total Project Outflow
Spill
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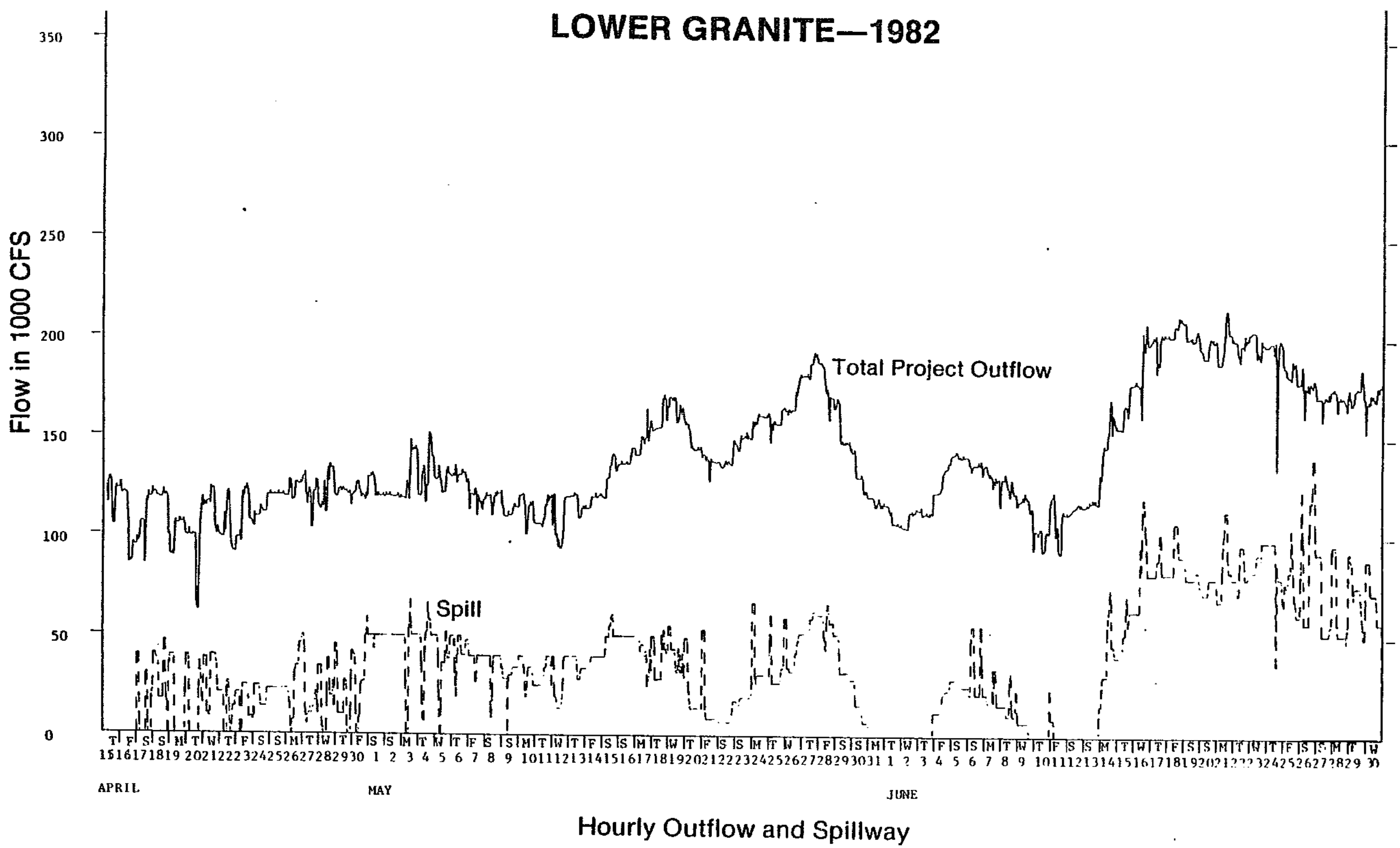
JULY
AUGUST
Hourly Outflow and Spillway



LOWER GRANITE—1982
Flow in 1000 CFS
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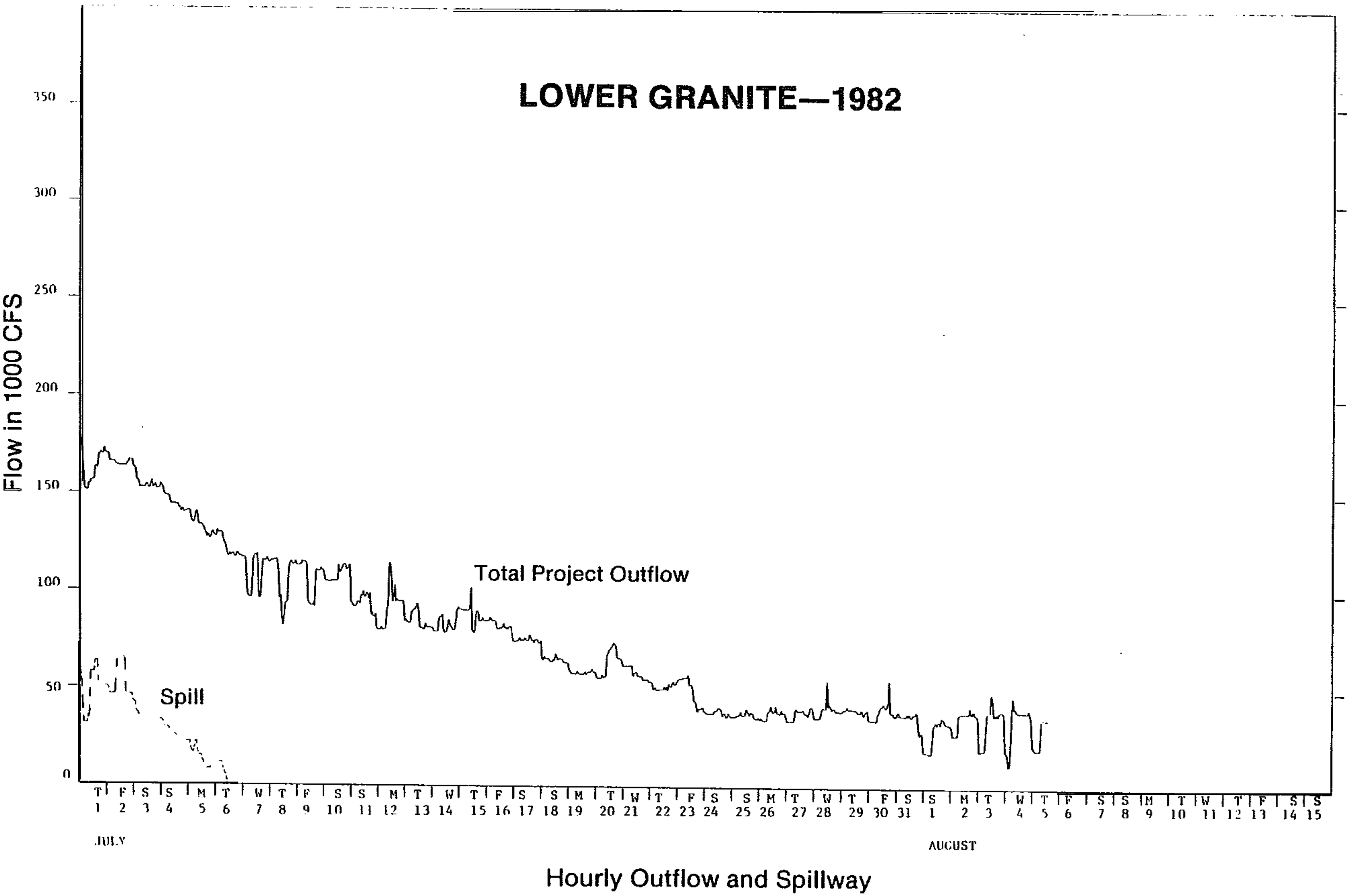
Total Project Outflow
Spill
APRIL
MAY
JUNE
Hourly Outflow and Spillway

LWG



LOWER GRANITE—1982
Flow in 1000 CFS
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Total Project Outflow
Spill
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AUGUST
Hourly Outflow and Spillway

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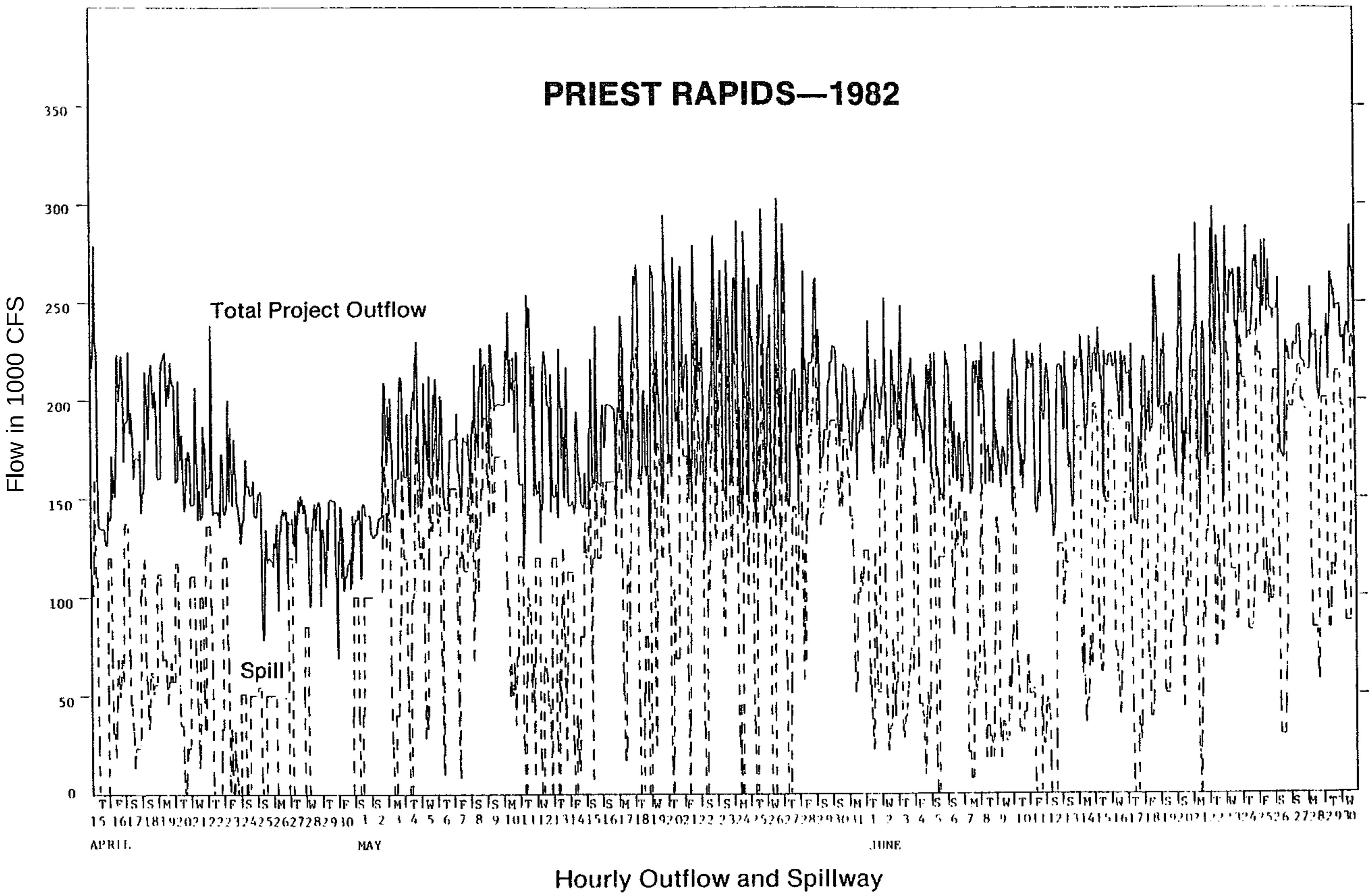
PRIEST RAPIDS—1982
Total Project Outflow
Spill
Flow in 1000 CFS
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JUNE
Hourly Outflow and Spillway

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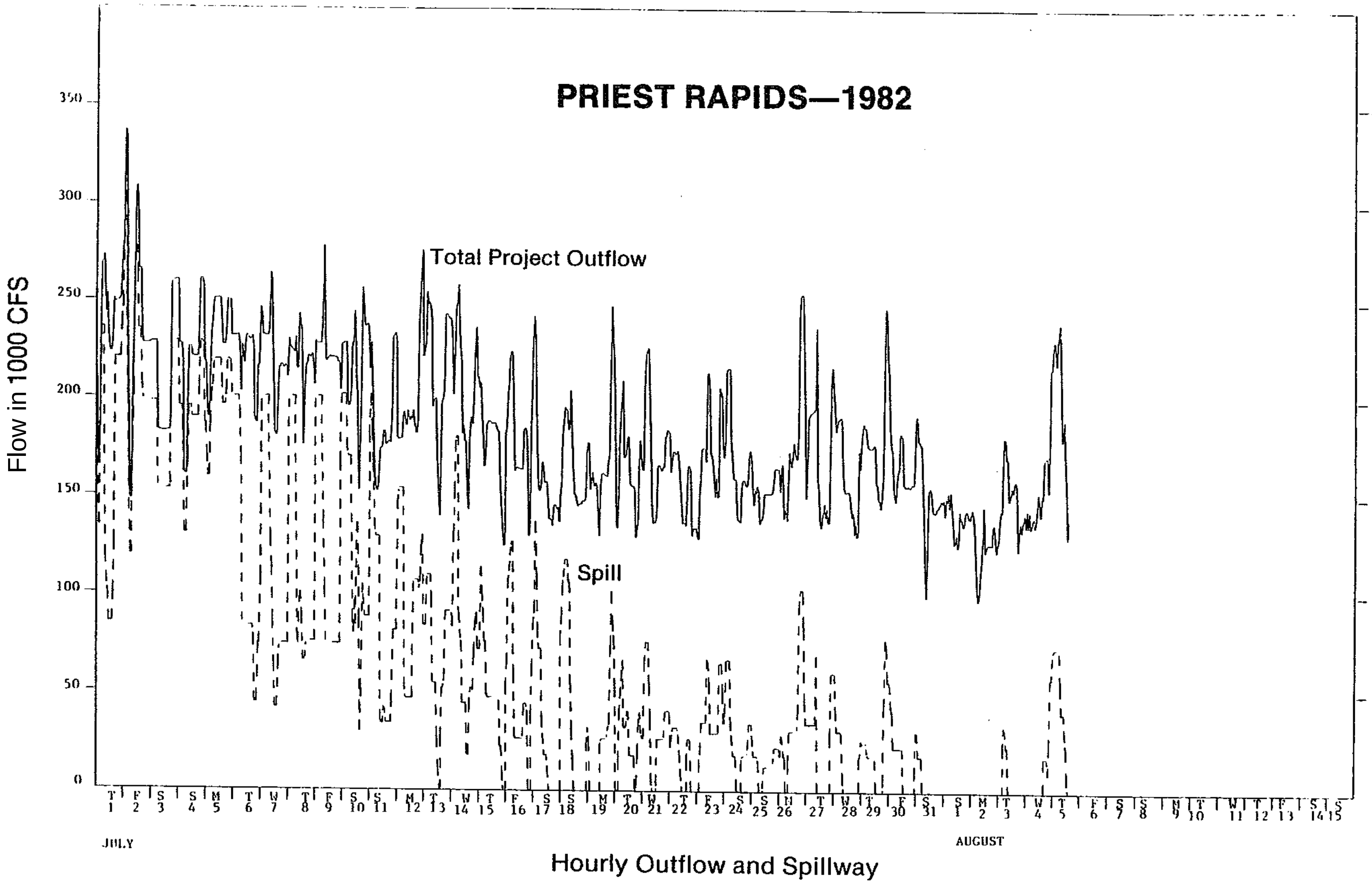
PRIEST RAPIDS—1982
Total Project Outflow
Spill
Flow in 1000 CFS
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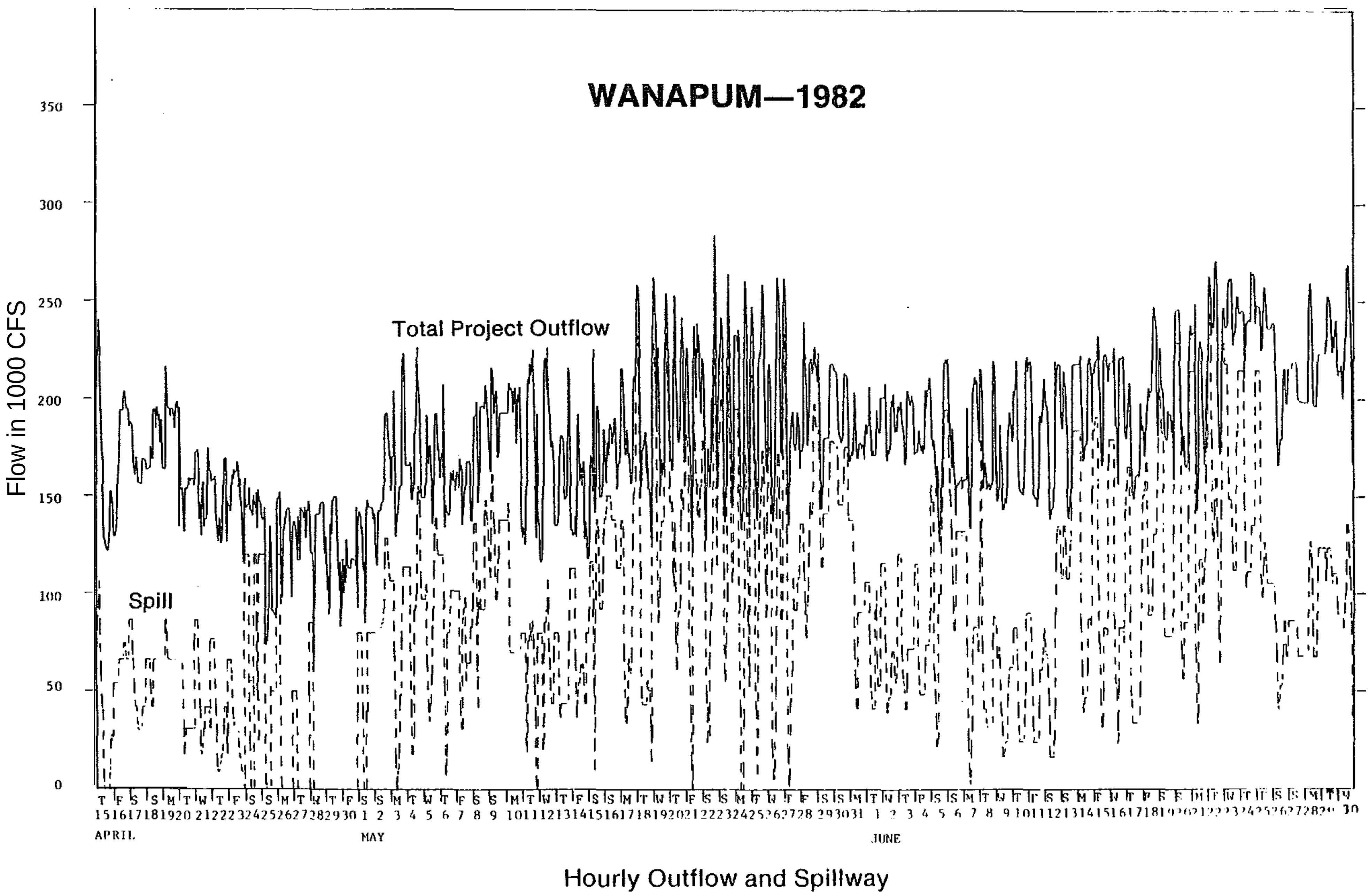
JULY
AUGUST
Hourly Outflow and Spillway



WANAPUM—1982
Total Project Outflow
Spill
Flow in 1000 CFS
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APRIL
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JUNE
Hourly Outflow and Spillway

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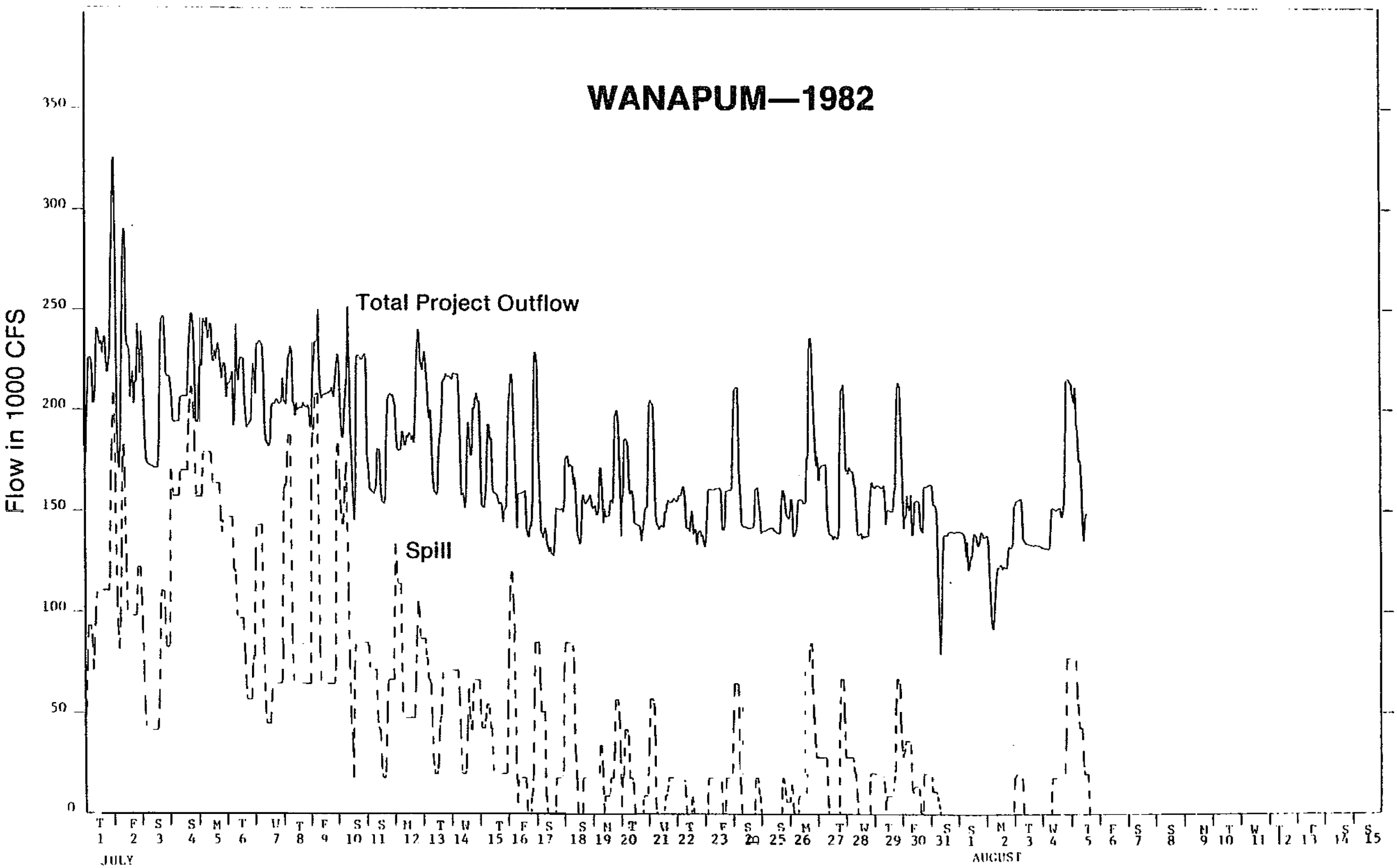
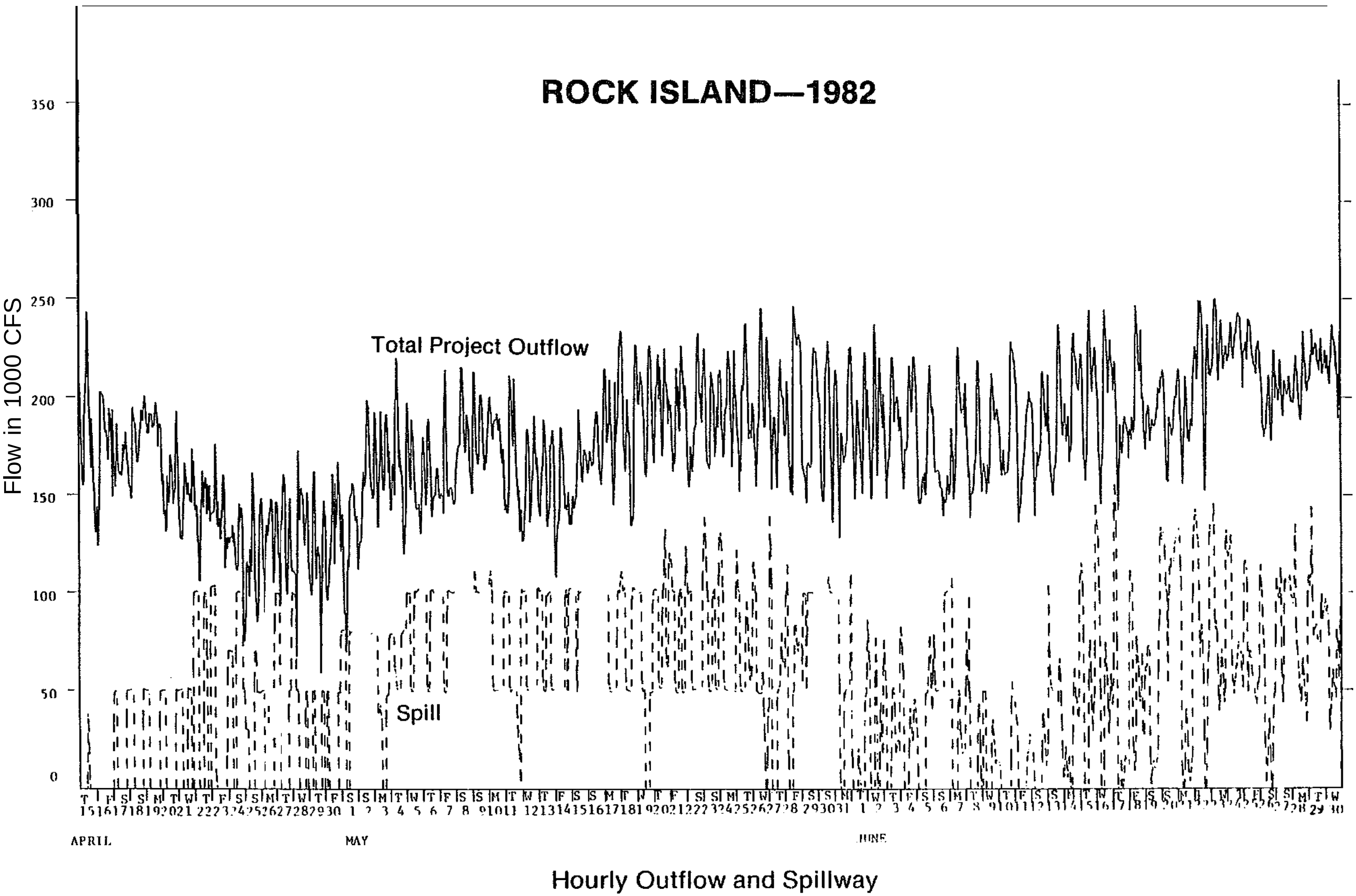


Hourly Outflow and Spillway


ROCK ISLAND—1982
Total Project Outflow
Spill
Flow in 1000 CFS
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APRIL
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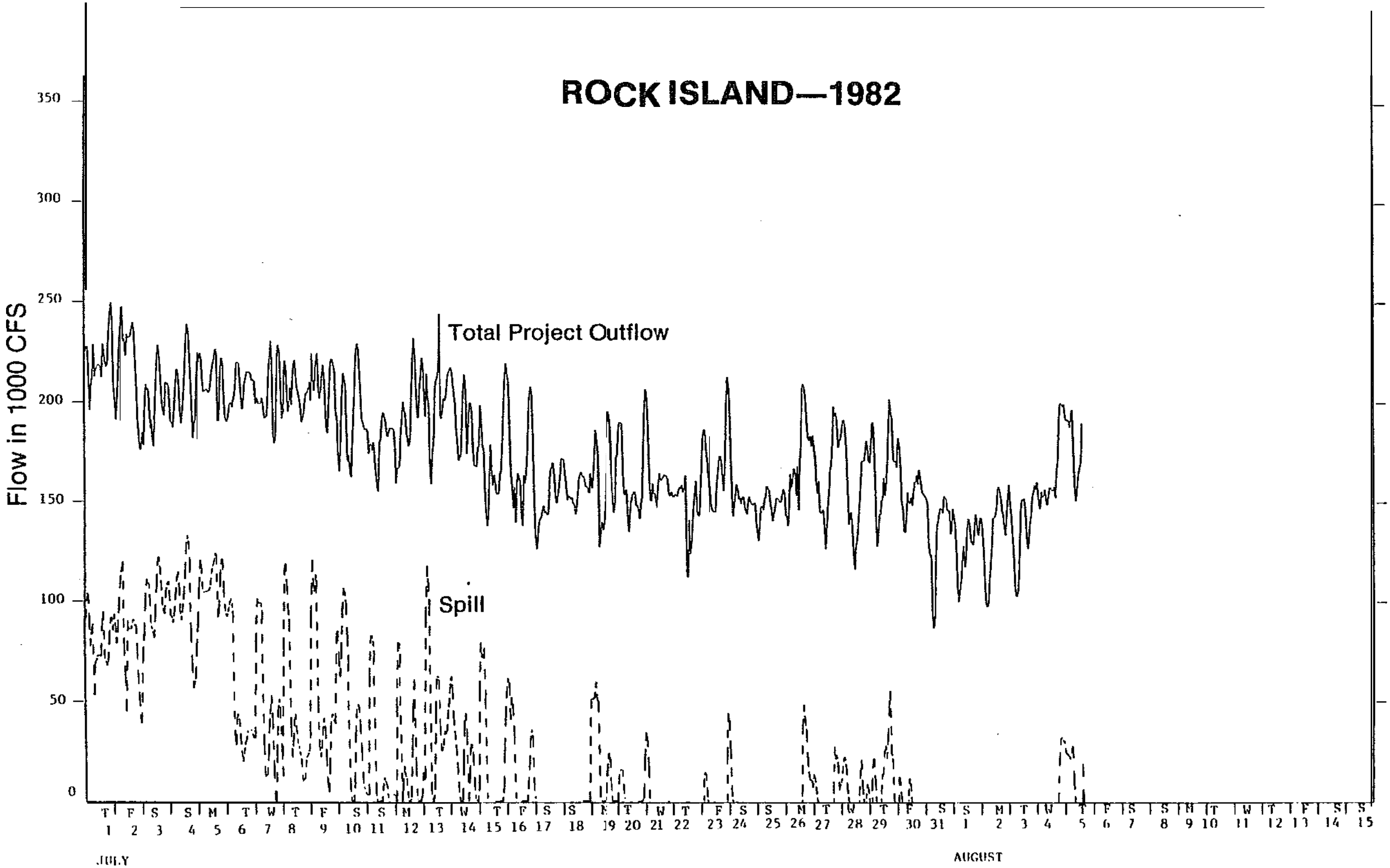
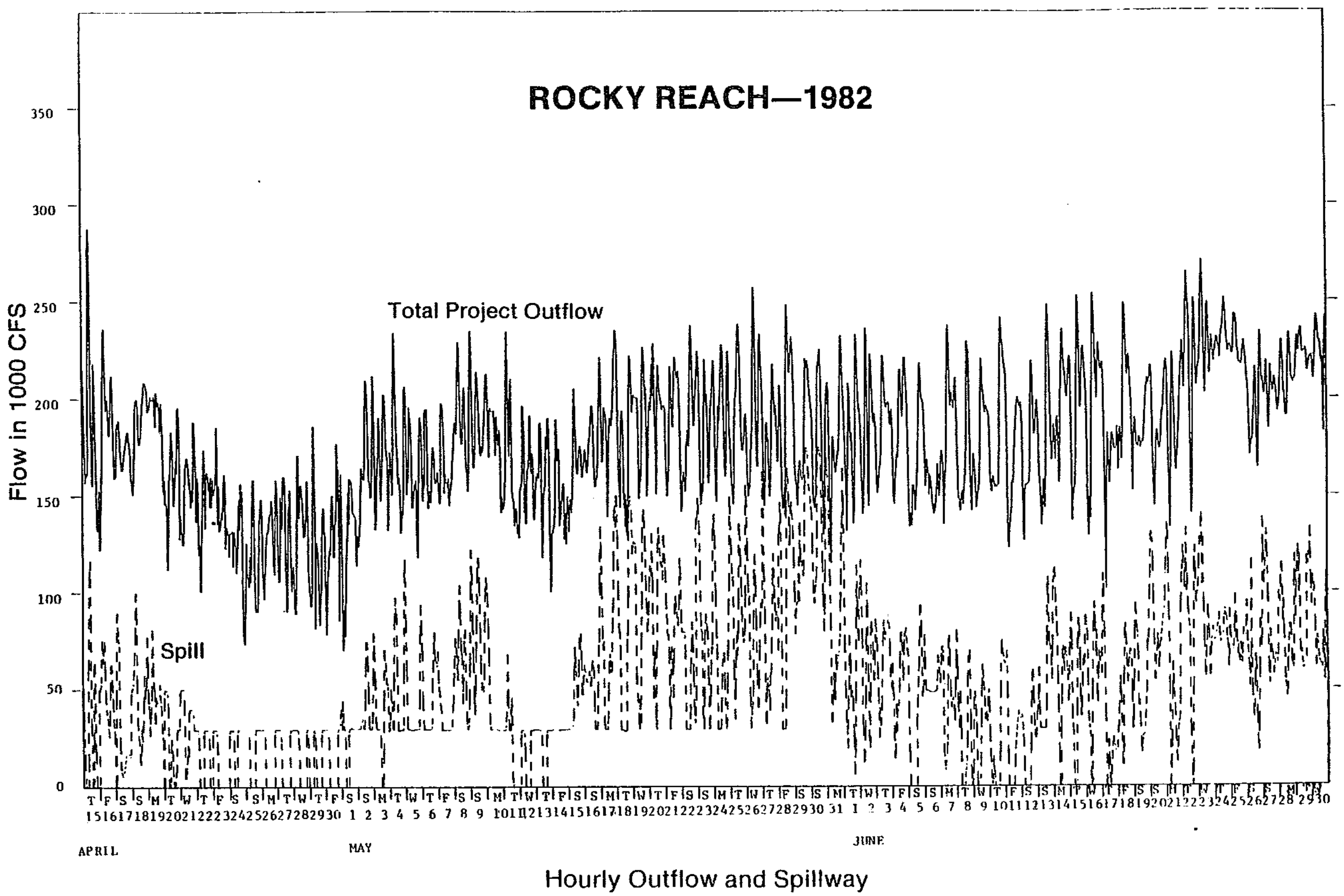
Hourly Outflow and Spillway



Hourly Outflow and Spillway



ROCKY REACH—1982
Total Project Outflow
Spill
Flow in 1000 CFS
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Hourly Outflow and Spillway

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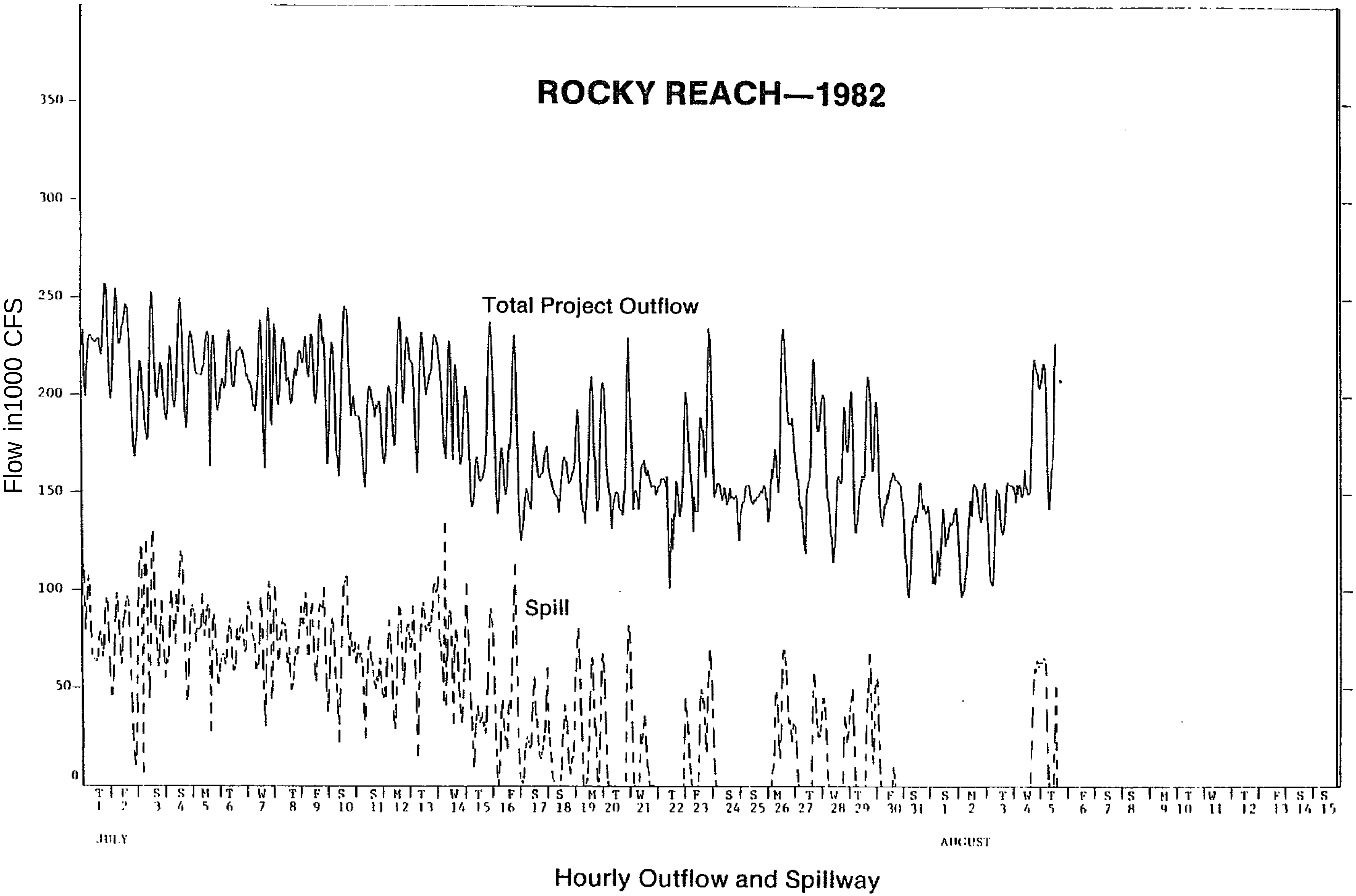
ROCKY REACH—1982
Total Project Outflow
Spill
Flow in1000 CFS
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JULY
AUGUST
Hourly Outflow and Spillway

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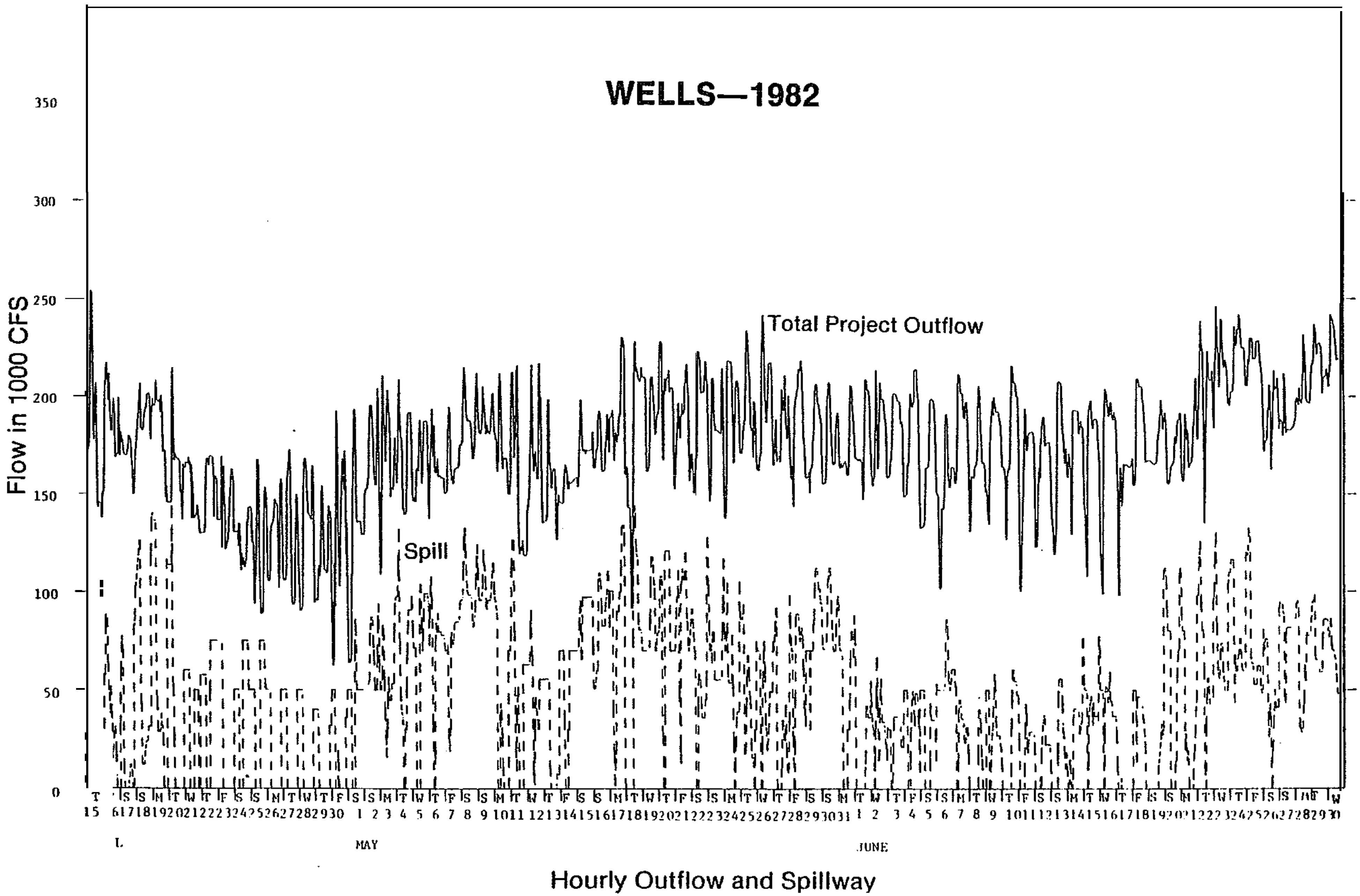
WELLS—1982
Total Project Outflow
Spill
Flow in 1000 CFS
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JUNE
Hourly Outflow and Spillway

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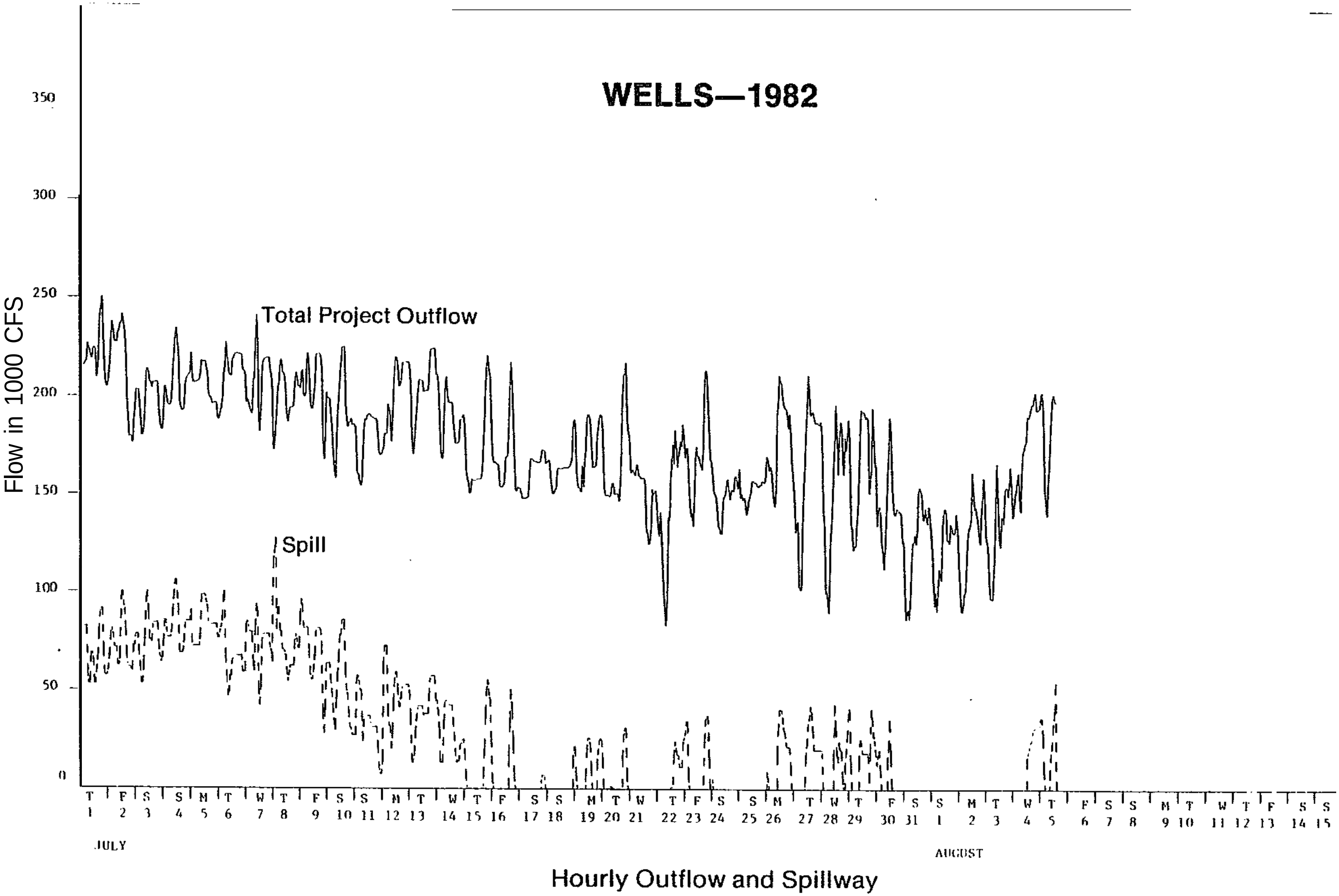
WELLS—1982
Total Project Outflow
Spill
Flow in 1000 CFS
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T F S S M T W T F S S M T W T F S S M T W T F S S M T W T F S S M T W T F S S M T W T F S S
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JULY
AUGUST
Hourly Outflow and Spillway

Public Utility District No.1
of Douglas County

RECEIVED

DEC 30 1982

December 28, 1982

Mr. Terry Holubetz
Columbia River Fisheries Council
Lloyd Building Suite 250
700 N. E. Multnomah
Portland, Oregon 97232

Dear Mr. Holubetz:

Enclosed is Douglas County P.U.D.'s report on 1982 fisheries studies for the COFO report. If you have any questions, please contact Mike Erho or myself.

Very truly yours,

Jim McGee
Biological Researcher

JMcG:ah
Enclosure

1151 Valley Mall Parkway • East Wenatchee, Washington 98801 • 5091884.7191

INPUT FROM DOUGLAS COUNTY P.U.D.
ON FISH FLOW 1982 IN THE MID-COLUMBIA

Introduction

In 1982 Douglas P.U.D.'s fisheries activities were again governed by the terms of the 5-Year F.E.R.C. Settlement Agreement as has been the case since 1980. These activities involved studies of: (1) the downstream migration at Wells Dam and the tributaries upstream, (2) two-dimensional modeling of the Wells Hydrocombine to investigate bypass concepts, (3) preliminary prototype bypass testing, (4) steelhead imprinting and transport, and (5) manipulation of powerhouse and spillway operation to provide spill for enhancing passage of downstream migrants at Wells Dam. Douglas P.U.D. was also involved in the 1982 Systems Mortality Study which estimated mortality of spring chinook smolts from above Wells Dam to below Priest Rapids Dam. Additional data was collected on mortality from above Wells to below Rock Island, Rock Island to below Priest Rapids and from Priest Rapids to McNary.

Spill

Spill was provided at Wells Dam during the downstream migration to aid fish passage. Table 1 shows the daily inflow at Wells from April 17 through May 31 and the volume of spill for relief of dissolved gas supersaturation on the lower Columbia River and F.E.R.C. "fish spill" and inadvertent spill. A total of 4,943 KAF was spilled at Wells Dam during the spring migration period. Average daily flow during the same period was 166.7 kcfs.

TABLE 1 - WELLS DAM SPILL FOR FISH FLOW 1982

Date	KCFS Inflow	Downstream Nitrogen Abatement	Forced * Spill	F.E.R.C. Spill	Total Spill
April 17	169.5	43.8	1.8		45.6
18	191.8	62.6	55.1		117.7
19	183.6	72.4	50.5		122.9
20	155.2	70.4	9.6		80.0
21	151.6	72.8	0		72.8
22	146.1	107.0	0		107.0
23	138.3	45.4	0		45.4
24	145.4	97.1	0		97.1
25	116.3	82.6	.3		82.9
26	125.9	37.2	0		37.2
27	120.0	37.2	0		37.2
28	131.3	24.8	0	9.9	34.7
29	121.4	0	0	27.8	27.8
30	125.2	28.1	2.7	4.1	34.9
May 1	143.8	82.6	7.3	0	89.9
2	164.8	99.1	26.0	0	125.1
3	164.5	45.4	58.6	.8	104.8
4	173.3	35.5	97.8	0	133.3
5	169.3	109.9	28.2	0	138.1
6	165.2	115.6	26.8	0	142.4
7	164.3	115.6	22.8	0	138.4
8	185.9	138.8	61.3	0	200.1
9	188.7	138.8	64.0	0	202.8
10	175.0	52.0	26.7	0	78.7
11	156.5	71.6	32.5	0	104.1
12	149.3	58.7	9.1	32.9	100.7
13	163.5	25.5	.8	24.5	50.8
14	161.6	102.4	0	.4	102.8
15	172.6	132.2	44.8	0	177.0
16	174.2	120.9	44.2	0	165.1
17	174.4	109.0	63.1	1.5	174.5
18	194.5	62.8	33.8	17.1	113.7
19	192.4	109.0	31.7	24.4	165.1
20	198.9	84.3	37.0	44.1	165.4
21	191.7	108.2	47.8	13.2	169.2
22	189.6	40.5	51.5	7.4	99.4
23	185.0	82.6	60.8	0	143.4
24	191.5	40.5	65.3	4.0	109.8
25	193.1	34.1	**44.8**	13.3	**92.8**
26	192.5	34.7	45.8	12.6	93.1
27	186.8	34.7	21.6	7.6	60.9
28	186.3	63.6	59.8	6.7	130.1
29	179.4	132.2	30.9		163.1
30	178.4	138.8	28.8		167.6
31	172.5	67.7	27.2		94.9
TOTALS		3370.2	1320.8	252.3	4943.3

*Forced spill for reservoir elevation control.

The cost of F.E.R.C. spill at Wells Dam, calculated on the market value of 4.7 mills per KWH from April 17 through May 31 amounted to $8,408. Water spilled for relief of dissolved gas supersaturation on the lower Columbia River was replaced in energy by B.P.A.

Migrant monitoring with hydroacoustic equipment, tributary and forebay smolt sampling were used to determine the migrant diel timing at the dam. Actual hours of F.E.R.C. spill were adjusted daily during the season to fill in time or volume of spill discharge to match migrant indices when dissolved gas supersaturation abatement spill was not available. Spill was increased and adjusted as the hydroacoustic monitoring data showed the need for differing spill patterns.

Deep spill was utilized during the entire fish migration period. Depending upon the volume of spill discharge between 3 and 7, spill gates were open during spill operation. Spill discharge was shaped to provide the highest volume of spill from spill bay 6 and stair step reductions of spill discharge from the bays on both sides. The hours per day of spill discharge at Wells Dam is shown in Table 2.

Migrant Monitoring

Monitoring of downstream migrant salmon and steelhead trout at Wells Dam was accomplished in 1982 by the use of hydroacoustic sampling, migrant trapping in the Okanogan River and purse seining in the forebay. The objective of this sampling was to provide additional information on the seasonal timing of the downstream migration by species and to provide an evaluation of the effectiveness of spill for protecting migrating salmonids.

TABLE 2 - TOTAL HOURS OF SPILL DISCHARGE PER DAY AT WELLS DAM, APRIL 17-MAY 31, 1982

		Total Hours Spilled
April	18	16.5
	19	23.5
	20	17.0
	21	10.5
	22	21.0
	23	19.0
	23	8.0
	24	19.0
	25	17.0
	26	9.0
	27	9.0
	28	9.0
	29	9.0
	30	10.0
May	1	20.0
	2	24.0
	3	24.0
	4	22.0
	5	19.0
	6	21.5
	7	24.0
	8	24.0
	9	24.0
	10	17.5
	11	17.0
	12	23.0
	13	17.0
	14	24.0
	15	24.0
	16	24.0
	17	23.5
	18	13.0
	19	24.0
	20	21.5
	21	24.0
	22	21.0
	23	24.0
	24	23.0
	25	23.0
	26	22.0
	27	17.5
	28	21.0
	29	24.0
	30	24.0
	31	18.0

Hydroacoustic Sampling

Hydroacoustic sampling at Wells Dam was conducted by Biosonics, Inc. from April 7 to May 23, 1982. Study objectives were to provide comparative indices of migrant passage to provide fish spills when migrants were present in the forebay. Figure 1 shows the evening and early morning hydroacoustic indices for Wells Dam in 1981 and 1982. The effectiveness of spill for fish passage at Wells Dam was also investigated utilizing the vertical distribution of migrants at the face of the dam and in powerhouse and spillway discharge.

Tributary Sampling

Juvenile sockeye salmon rear naturally in Lake Osoyoos and migrate out of the Okanogan River. Biosonics, Inc. conducted a pre and post migration hydroacoustic survey of Lake Osoyoos to provide information on the size of the sockeye outmigration in 1982. A sampling effort utilizing an incline plane trap was conducted again in 1982 to provide additional information on the timing of the sockeye outmigration. Sampling began on April 7 and continued until May 19 when the trap was damaged by debris. Sockeye were first collected on April 9 and continuing throughout the sampling period (Figure 2).

Wells Forebay Sampling

Purse seine sampling in Wells Dam forebay was conducted from April 12 to May 29, 1982. Chinook smolts were captured from April 14 to the end of sampling. The majority of the chinook were collected between April 22 and May 7, 1982 (Figure 3). Steelhead were first captured on April 22 and captures continued sporadically through the entire study period. Figure 4 gives the catch of steelhead juveniles in the Wells Dam forebay.

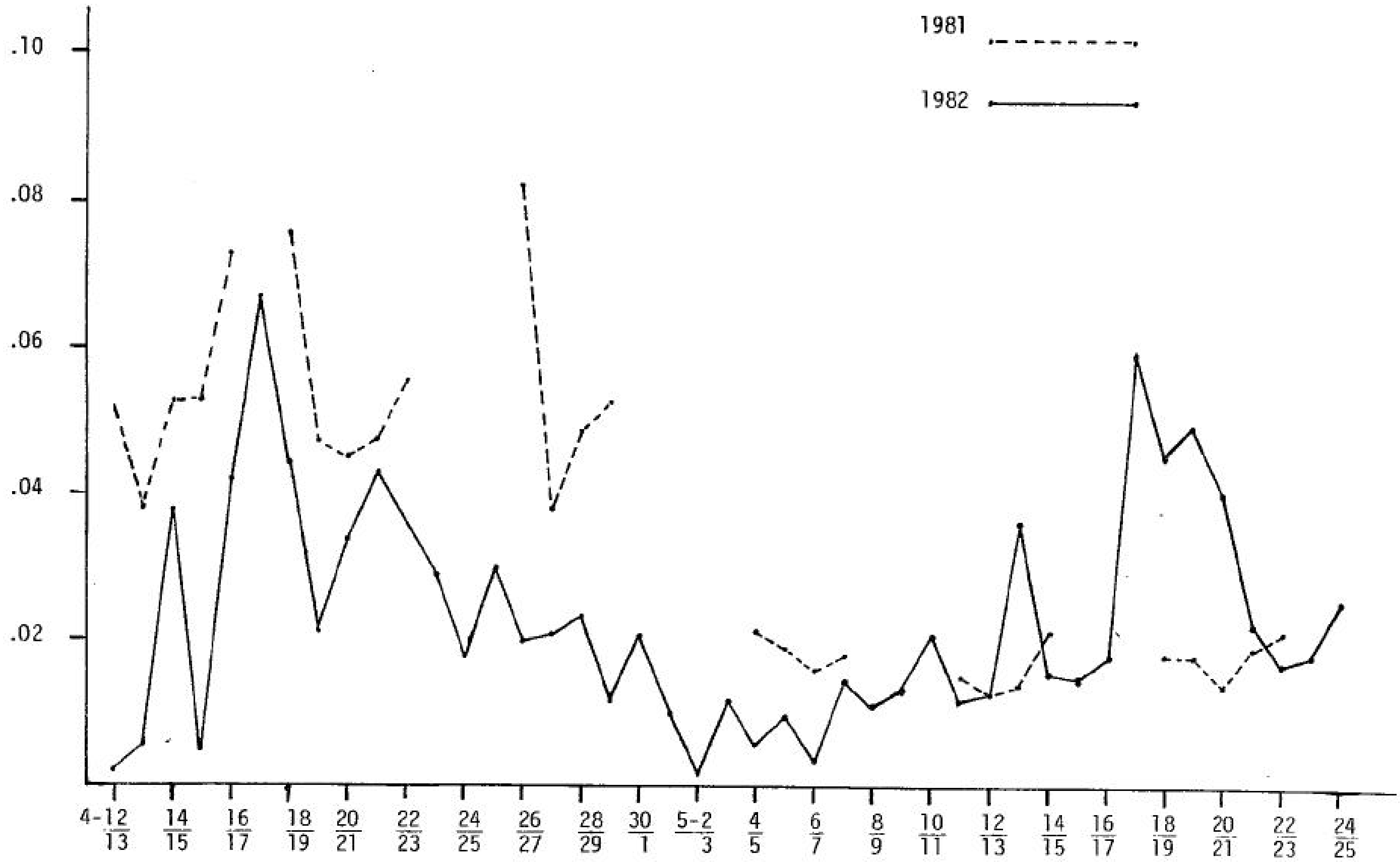


FIGURE 1. - HYDROACOUSTIC INDICES FOR WELLS DAM 1981 AND 1982 - 1600-0700 HOURS

2 M OF JUVENILE SOCKEYE CAUGHT PER DAY IN THE OKANAGAN RIVER 1982

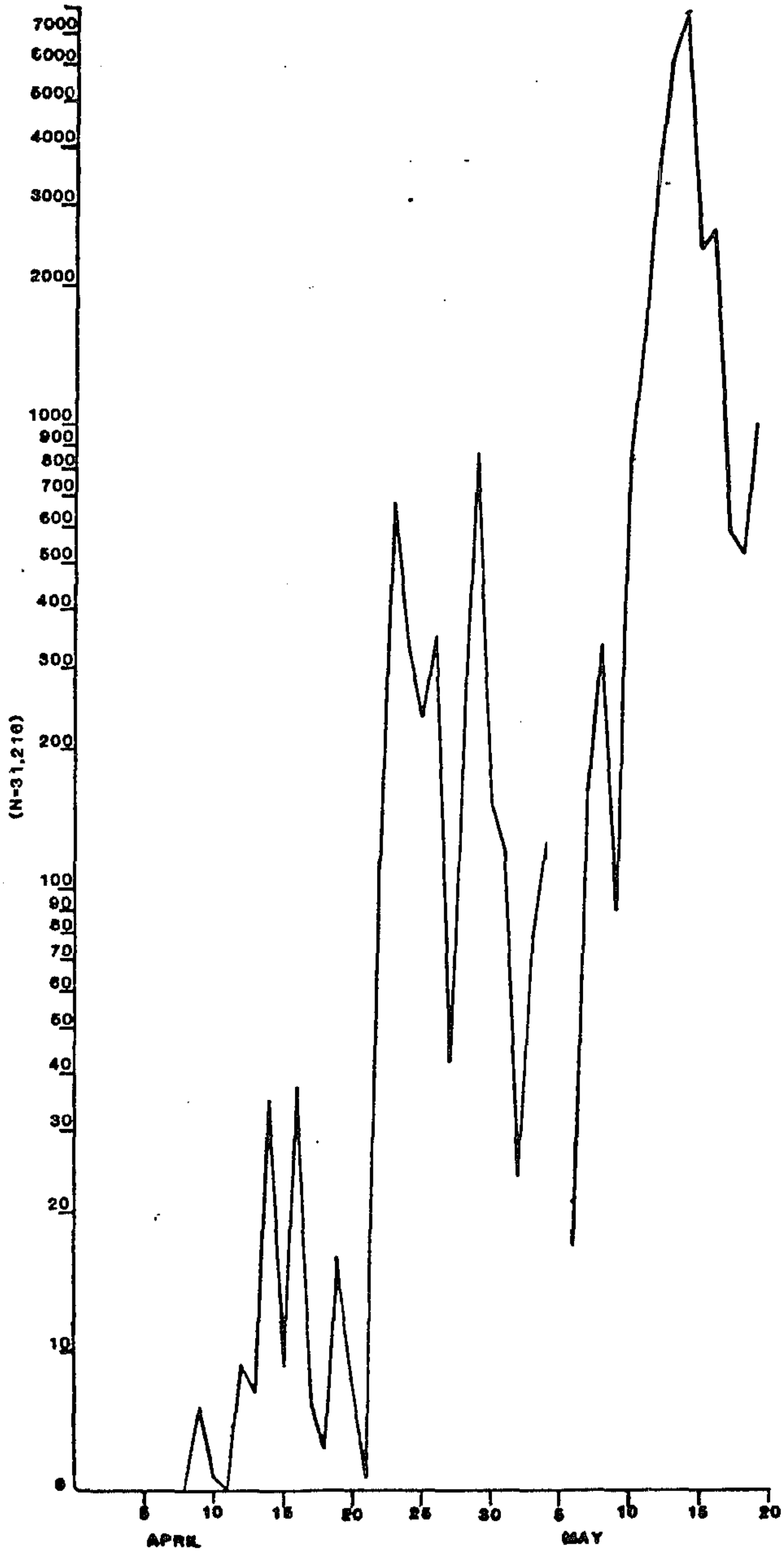
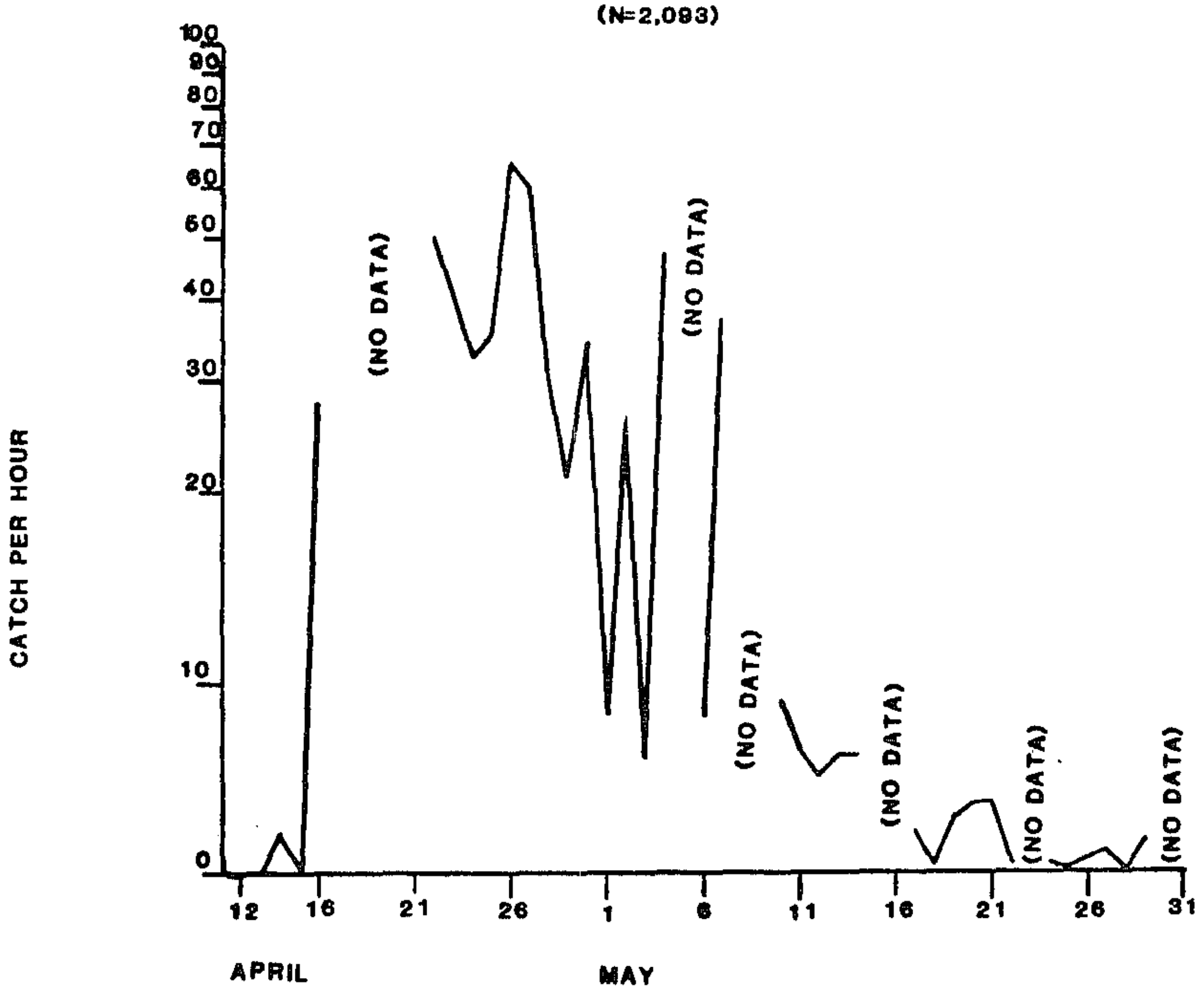


FIGURE 3 JUVENILE CHINOOK CATCH PER HOUR OF PURSE SEINE FISHING WELLS DAM FOREBAY 1982



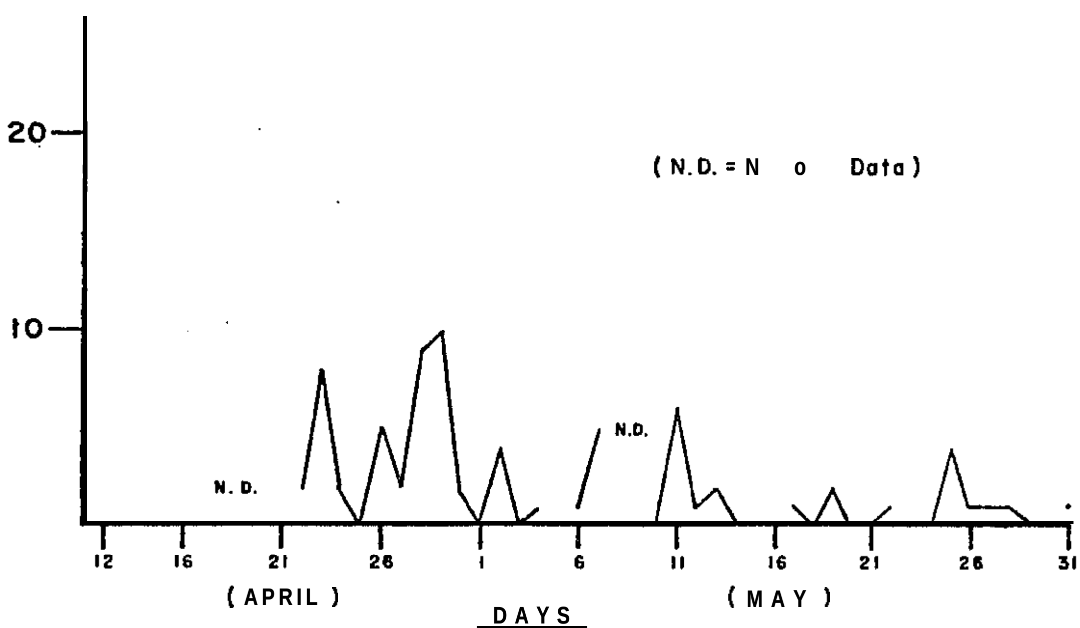


Figure 4 -JUVENILE STEELHEAD DAILY CATCH
WELLS, DAM FOREBAY (1982)
(N=72)

Sockeye were first collected on April 21 with peak catches on May 14 and May 24 (Figure 5). Sockeye were still being collected in the forebay when sampling was terminated.

Two-Dimensional Model Test

Hydro Research Science, Inc. conducted two-dimensional model tests of downstream migrant bypass concepts for Wells Dam. The objective of the model testing was to assist in determining the feasibility of altering inflow patterns at the hydrocombine. Structural modifications were tested to provide information for the design of potential prototype bypasses.

Preliminary Prototype Bypass Testing

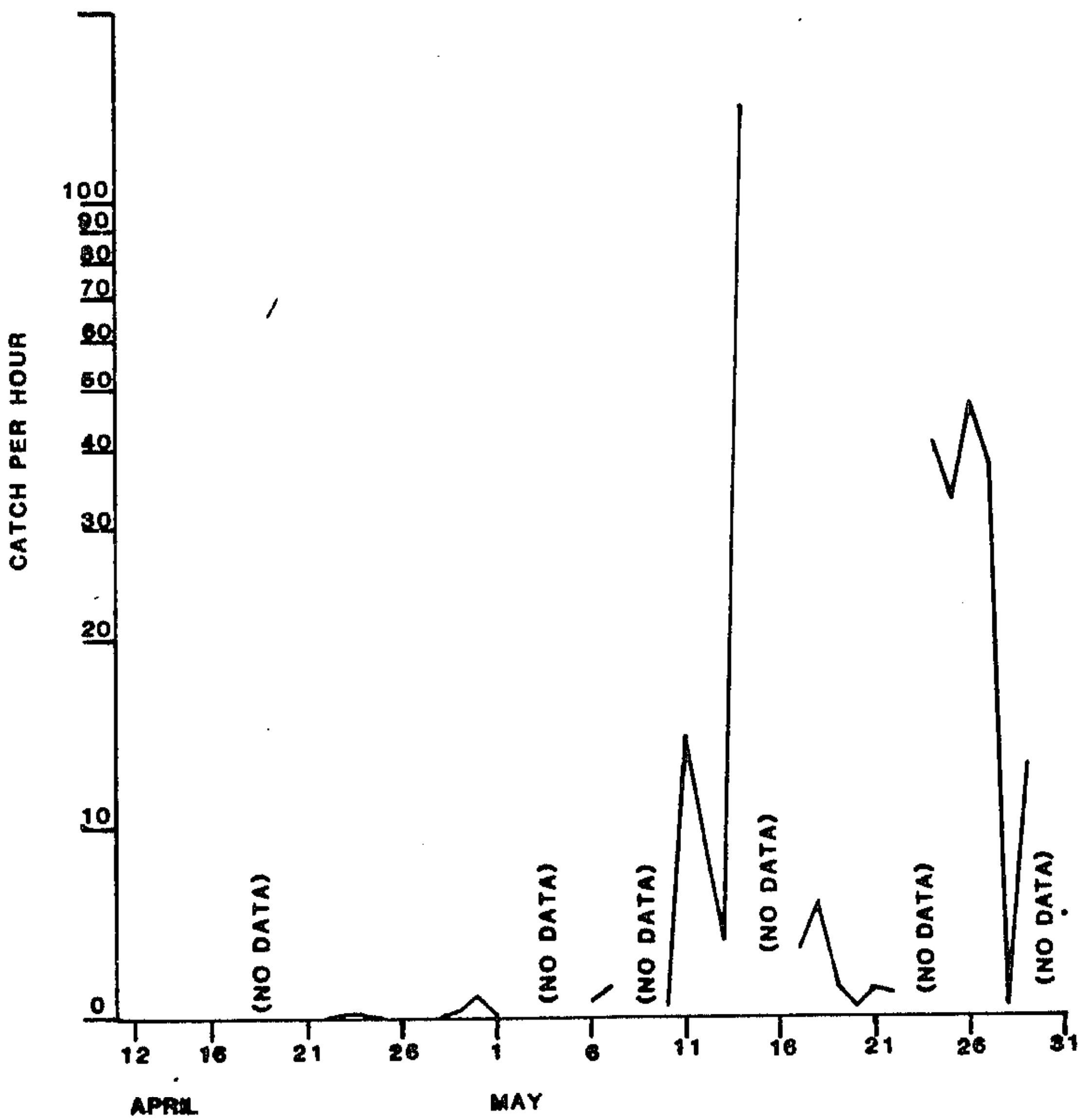
Preliminary testing of two prototype bypass concepts was undertaken at the Wells Hydrocombine in July. Water velocities in front of the prototype bypasses were measured at various spillway and turbine discharges. Preliminary testing was conducted to provide information on equipment needed to evaluate prototype bypass concepts and to compare prototype results with those seen in the two-dimensional model studies.

Steelhead Imprinting/Transport Study

The first year of a two-year marking program for a steelhead imprinting/ transport study was completed in 1982. Juvenile steelhead from Wells Hatchery were released into an irrigation ditch fed by Methow River water near Twisp, Washington. The steelhead were allowed to migrate six miles downstream voluntarily and were collected. Two groups of steelhead were marked. The control group was released into the Methow River at the

FIGURE 5 JUVENILE SOCKEYE CATCH PER HOUR OF PURSE SEINE FISHING WELLS DAM FOREBAY 1982

(N=955)



collection site and the experimental group transported below Priest Rapids Dam on the Columbia. Initial recoveries are expected in the fall of 1983.

SUMMARY OF 1982 SPECIAL PROJECT OPERATIONS AND STUDIES TO IMPROVE JUVENILE SALMONID SURVIVAL CHELAN COUNTY PUBLIC UTILITY DISTRICT

The Chelan County Public Utility District worked on two phases in 1982 to increase juvenile salmonid survival at the Rocky Reach and Rock Island Hydroelectric Projects. The District continued to provide interim fish protection by spilling part of the river's flow as provided in the F.E.R.C. Settlement Agreement Order of March, 1980. The District also assisted the COFO smolt coordinator, fisheries agencies, and water management and operating agencies in redistributing forced spill resulting from high river flows in order to maximize benefits for downstream fish passage and minimize the incidence of dissolved gas supersaturation. In the second phase, the District and fishery agencies made substantial progress toward development of downstream migrant bypass facilities at both projects. The spill operations, migration monitoring programs, and studies related to development of bypass systems are described below for each project, with summary tables and figures following.

ROCKY REACH

Spill Operations:

Spill timing and quantities were determined by the F.E.R.C. Order designated representatives (one District biologist and two fishery agency biologists). The designated representatives consulted with the COFO smolt-coordinator to make best use of system transfers of forced spill and shaped the spill program to match the fish migration, providing the highest quantites and most hours of spill during peaks in fish abundance. At times when considerable system forced spill was available, the designated representatives worked with the smolt coordinator to avoid gas supersaturation while maintaining optimal downstream fish passage conditions.

The optimal spill configuration for fish passage at Rocky Reach, as determined by concensus of the designated representatives based on the available evidence, consisted of one or more spillgates open full to provide surface attraction flows. Spillgates 3 and 4 were the primary gates used since they were both rated for full flow (30,000 cfs each) and were located near the powerhouse, where attraction flows stood the best chance of passing fish migrating down either side of the river. When spillway flows exceeded 60,000 cfs additional gates were used to spill the remainder. Spill was provided during the nighttime period of peak fish passage (8:00 p.m. to 6:00 a.m.) early in the season when limited spill was available. After May 5, when high streamflows caused more spill, at least 30,000 cfs of spill was provided at all times of day.

The 1982 Rocky Reach spill and flow parameters are tabulated in Table I. Due to system spill and energy transfers, a spill accounting system was developed to avoid depleting the spill quota of the F.E.R.C. Settlement Order at times when system energy replacement spii 1 was available. The F.E.R.C. Order quota was used to provide spill at times when insufficient system spill was available, thus maximizing fish survival benefits. In addition, due to high river flows anti limited turbine capacity, considerable involuntary pond regulation spill occurred in excess of the level required for optimum fish passage. Spill accounting is summarized in Table 2.

The F.E.R.C. Order spill quota, based on the April 1 yearly runoff forecast, was 669,000 acre-feet plus an additional 100,000 acre-feet of supplemental volume since the fish migration lasted more than 30 days. The Rocky Reach spill program utilized 560,132 acre-feet, or 73% of the quota, which resulted in energy losses of 28,581 MWH. The F.E.R.C. spill quota was used from April 17 through May 31. System energy replacement spill amounted to 2,261,568 acre-feet during the period from April 16 through May 31, and continued to occur through June and into July for purposes of dissolved gas abatement. Pond regulation spill from April 16 through May 31 was 1,864,083 acre-feet. Total spill at Rocky Reach during the spring juvenile salmonid migration (April 16 - May 31) was 4,685,784 acre-feet.

Rocky Reach spill volumes ranged from 6.4% to 72.4% of the daily average flow during the April 16 through May 31 period. Spill was greater than 9%, except for one day, from April 16 - 30. Spills of greater than 20% prevailed from May I to 15 except for May 11, 12 and 13. By order of the F.E.R.C., the spillbay caisson was removed from the spillway area, which necessitated stopping spill for 10 hours on May 11 and 9 hours on May 12. Spill was stopped for 6 hours on May 13 to raise the forebay pond elevation to optimize conditions for a fish release at the Turtle Rock hatchery. Spill was greater than 30% of the daily average flow from May 16 - 31, with 13 of those days having spills greater than 40%.

Migration Monitoring:

The 1982 Rocky Reach migration monitoring program consisted of hydroacoustic arrays in the powerhouse area, tailrace seagull counts, and gatewel? dipnet samples. The hydroacoustic daily smolt index is shown in figures 1 & 2 and the seagull counts and gatewell samples are shown in figures 3 & 4.

The hydroacoustic apparatus was in operation from April 19 through May 24 and from June 14 through July 12. The daily smolt index data was generated during a study of smolt vertical and horizontal distribution conducted by Biosonics, Inc. The index is expressed as the daily average number of fish per minute in front of various turbine units. Tailrace seaguil counts were made three times daily and averaged. Gatewell samples were taken from one gate slot, removing ail available fish from the slot once daily during the peak of the migration and less often before April 19 and after May 21.

In general, these nonitoring methods showed few fisn prior to April 15, with a rapid increase in numbers from April 16 to 19. Fish numbers remained at high to mode!-ate levels through May 20, then declined rapidly. The spring migration was essentially finished by May 31. Hydroacoustic monitoring showed a relatively stable fish passage rate from late April through late May with one bump in the curve following fish releases from the Turtle Rock hatchery, located 1 3/4 miles upstream on May 5 and 13. Seagull counts and gatewell dipnet samples showed the majority of the spring chinook and steelhead migrants passed Rocky Reach between April 19 and May 15. Most coho passed Rocky Reach between the May 5 release and May 15, while the sockeye migration peaked between May 21 and 28.

Subyearling summer chinook migrants began appearing in the gatewell samples on June 4 and small numbers were captured until June 18; then very few chinook were taken and gatewell samples were discontinued on July 2. Hydroacoustic data showed moderate levels of summer migrants during the same period, then an increase in numbers began after July 2 and fairly high indices were recorded through the remainder of the study, which concluded July 12. Based on the size and appearance of the summer migrants taken from the gatewells in early June, we concluded that those early fish were primarily from the Wells hatchery and represented the larger individuals from their release. The wild migrants and probably the majority of the Wells hatchery release were just starting to migrate past Rocky Reach in early June.

Studies:

Two studies of fish behavior were conducted at Rocky Reach in 1982. The District contracted with Biosonics, Inc. to conduct hydroacoustic studies of fish distribution in the powerhouse forebay area and in the turbine intakes. The primary objectives of this study were to determine the vertical distribution of smolts as they enter and pass through the turbine intakes and the horizontal distribution of smolt passage across the powerhouse. The results of this study will be used in the development of permanent smolt bypass facilities.

An evaluation and feasibility study of a static smolt guidance net was conducted by CH2M Hill for the District. The study was conducted to determine if static guidance devices in the powerhouse forebay showed potential as an alternative method for permanent fish guidance and bypass facilities.

These studies were conducted in accordance with the F.E.R.C. Order Settlement Agreement with studies committee involvement and approval. The reports of study results are in preparation and will be available in early 1983.

ROCK ISLAND

Spill Operations:

Spill timing and quantities were determined by the F.E.R.C. Order designated representatives (one District biologist and two fishery agency biologists). The designated representatives consulted with the COFO smolt coordinator to make best use of system transfers of forced spill and shaped the spill program to match the fish migration, providing the highest quantities and most hours of spill during peaks in fish abundance. At times when considerable system forced spill was available, the designated representatives worked with the smolt coordinator to avoid gas supersaturation while maintaining optimal downstream fish passage conditions.

The optimal spill configuration for fish passage at Rock Island. as determined by concensus of the designated representatives based on the available evidence, consisted of one or two deep gates open full (20,000 cfs per gate) adjacent to the second powerhouse and one deep gate spilling 10,000 cfs on the first powerhouse side of the river. If spill volumes exceeded 50,000 cfs, the additional spill was divided between the second powerhouse channel and the first powerhouse channel in the same ratio as the proportion of total turbine discharge attributable to the respective powerhouse. The primary spillgates used during the season were gates 30 and 31 adjacent to the second powerhouse and gate 3 or 4 near the first powerhouse. When these gates were fully open, additional spill was distributed between various deep or shallow gates equipped with automatic controls, primarily in the second powerhouse channel. Early in the season, when limited spill was available, most spill took place during the period of peak fish passage, from 8:00 p.m. to 6:00 a.m. After May 5 a minimum spill volume of 50,000 cfs was maintained throughout the day.

The 1982 Rock Island spill and flow parameters are tabulated in Table 3. Due to system spill and energy transfers, a spill accounting system was developed to avoid depleting the spill quota of the F.E.R.C. Settlement Order at times when system energy replacement spill was available. The F.E.R.C. Order quota was used to provide spill at times when insufficient system spill was available, thus maximizing fish survival benefits. In addition, due to high river flows and limited turbine capacity, considerable involuntary pond regulation spill occurred in excess of the level required for optimum fish passage. Spill accounting is summarized in Table 4.

The F.E.R.C. Order spill quota, based on the April 1 yearly runoff forecast and operation of the first powerhouse was 658,998 acre-feet, plus an additional 100,000 acre-feet of supplemental volume since the fish migration lasted more than 30 days. The Rock Island spill program utilized 809,218 acre-feet, or 107% of the quota, which resulted in energy losses of 16,351 MWH. The F.E.R.C. spill quota was used from April 17 through May 26. System energy replacement spill amounted to 4,482,215 acre-feet during the period from April 16 through May 31, and continued to occur through June and into July for purposes of dissolved gas abatement. Pond regulation spill from April 16 through May 31 was 260,130 acre-feet. Total spill at Rock Island during the spring juvenile salmonid migration (April 16 - May 31) was 5,551,562 acre-feet.

Rock Island spill volumes ranged from 10.8% to 59.3% of the daily average flow during the April 17 through May 31 period. Spill ranged from 10.8% to 55.8% and averaged 23% from April 17 - 30. Spill ranged from 27.1% - 59.3% from May 1 to 15, averaging 48% of the flow overall. Spill levels were above 25% from May 16 to 31, with an average spill of 39% of the daily average flow during that period.

Migration Monitoring:

The 1982 Rock Island migration monitoring program consisted of hydroacoustic arrays in the powerhouse area, sampling the second powerhouse fingerling bypass, and tailrace seagull counts. The hydroacoustic daily smolt index is shown in Figure 5, the fingerling bypass samples in figure 6, and the seagull counts in figure 7.

The hydroacoustic array was operating from April 13 through May 23 during a study of smolt vertical and horizontal distribution conducted by Biosonics, Inc. A daily smolt passage index, expressed as the daily average number of fish per minute recorded in front of two turbine units, was developed during the study. The second powerhouse fingerling bypass system was sampled and the daily fish passage was estimated during a study conducted by CH2M Hill. Tailrace seagull counts were made three times daily and averaged.

The migration monitoring programs generally showed few fish present prior to April 15, then a sudden increase in fish passage to high levels for the next five days marked the passage of spring chinook smolts released from the Leavenworth National Fish Hatchery. Fish passage rates continued at moderate to high levels through the rest of April and early May. Fish passage indices increased after May 10 as coho from the Turtle Rock hatchery passed Rock Island Dam. The spring yearling smolt migrations had declined by May 28 and indices remained low until mid June. A small increase in seagull counts about June 10 reflected the passage of chinook fry (40 - 50 mm fork length), presumably from the Wenatchee River. The fingerling bypass samples showed peak migration dates of April 23 for yearling chinook, April 30 for sockeye, May 18 for steelhead, and May 20 for coho salmon.

Studies:

Two studies of fish migratory behavior were undertaken at Rock Island in 1982. The District contracted with Biosonics, Inc. to conduct hydroacoustic studies of fish distribution in the powerhouse forebay area and turbine intakes. The primary objectives of this study were to determine the vertical distribution of smolts as they enter and pass through the turbine intakes and the horizontal distribution of smolt passage across the powerhouse. The results of this study will be used in the development of permanent smolt bypass facilities.

Studies of the collection efficiency and operating characteristics of the second powerhouse fingerling bypass system were conducted by CH2M Hill for the District. Objectives for this year's study were to determine collection efficiencies for spring chinook and steelhead and obtain a second year of data on coho to compare with the 1981 study. Also, the fish migration was sampled to provide timing data for COFO and District use in providing spill and flows for downstream migrants.

These studies were conducted in accordance with the F.E.R.C. Order Settlement Agreement with studies committee involvement and approval. The reports of study results are in preparation and will be available in early 1983.

TABLE 1
ROCKY REACH SPILL
FISH FLOW 1982

DATE		STREAM FLOW (SFD)	DAILY SPILL (SFD)	%STREAM FLOW SPILLED	TURBINE DISCHARGE (SFD)	DAILY SPILL (ACRE-FEET)	ACCUMULATED TOTAL SPILL (ACRE-FEET)
April	16	187,200	47,800	25.5	139,400	94,644	94,644
	17	174,500	28,600	16.4	145,900	56,628	151,272
	18	188,900	47,600	25.2	141,300	94,248	245,520
	19	192,700	42,400	22.0	150,300	83,952	329,472
	20	159,100	23,900	15.0	135,200	47,322	376,794
	21	153,500	32,800	21.4	120,700	64,944	441,738
	22	147,300	16,400	11.1	130,900	32,472	474,210
	23	144,320	9,242	6.4	135,079	18,299	492,509
	24	123,470	23,890	19.3	99,580	47,302	539,811
	25	116,810	18,710	16.0	98,100	37,046	576,857
	26	129,300	11,950	9.3	117,080	23,661	600,518
	27	129,170	14,360	11.1	114,810	28,433	628,951
	28	133,160	15,430	11.6	117,730	30,551	659,502
	29	118,210	11,760	9.9	106,450	23,285	682,787
	30	127,090	14,820	11.7	112,270	29,344	712,131
May	1	127,850	25,780	20.1	102,070	51,044	763,175
	2	159,350	38,570	24.2	120,780	76,369	839,544
	3	172,610	39,420	22.8	133,190	78,052	917,596
	4	168,620	48,900	29.0	119,720	96,822	1,014,418
	5	165,780	42,270	25.5	123,510	83,695	1,098,113
	6	165,350	46,240	28.0	119,110	91,555	1,189,668
	7	162,880	36,100	22.2	126,780	71,478	1,261,146
	8	186,400	62,800	33.7	123,600	124,344	1,385,490
	9	190,400	78,100	41.0	112,300	154,638	1,540,128
	10	185,500	42,700	23.0	142,800	84,546	1,624,674
	11	163,900	21,700	13.2	142,200	42,966	1,667,640
	12	160,700	17,400	10.8	143,300	34,452	1,702,092
	13	158,300	21,800	13.8	136,500	43,164	1,745,256
	14	146,900	29,400	20.0	117,500	58,212	1,803,468
	15	163,400	48,800	29.9	114,600	96,624	1,900,092
	16	174,600	55,700	31.9	118,900	110,286	2,010,378
	17	190,400	76,800	40.3	113,600	152,064	2,162,442
	18	177,600	83,200	46.8	94,400	164,736	2,327,178
	19	190,400	93,500	49.1	96,900	185,130	2,512,308
	20	198,400	99,900	50.4	98,500	197,802	2,710,110
	21	193,930	82,080	42.3	111,850	162,518	2,872,628
	22	182,230	59,030	32.4	123,200	116,879	2,989,507
	23	186,720	81,860	43.8	104,860	162,083	3,151,590
	24	194,000	65,170	33.6	128,830	129,037	3,280,627
	25	188,300	93,975	49.9	94,325	186,071	3,466,698
	26	192,980	82,080	42.5	110,900	162,518	3,629,216

T. 1
(Continued)

DATE		STREAM FLOW (SFD)	DAILY SPILL (SFD)	%STREAM FLOW SPILLED	TURBINE DISCHARGE (SFD)	DAILY SPILL (ACRE-FEET)	ACCUMUALTED TOTAL SPILL (ACRE-FEET)
May	27	181,380	81,820	45.1	99,560	162,004	3,791,220
	28	195,120	105,390	54.0	89,730	208,672	3,999,892
	29	180,040	126,550	70.3	53,490	250,569	4,250,461
	30	178,000	128,950	72.4	49,050	255,321	4,505,782
	31	180,080	90,910	50.5	89,170	180,002	4,685,784
June	1	182,140	61,750	33.9	120,390	122,265	4,808,049
	2	185,750	64,670	34.8	121,080	128,047	4,936,096
	3	186,600	65,720	35.2	120,880	130,126	5,066,222
	4	187,780	55,480	29.5	132,300	109,850	5,176,072
	5	168,200	33,690	20.0	134,510	66,706	5,242,778
	6	157,260	53,010	33.7	104,250	104,960	5,347,738
	7	187,440	45,990	24.5	141,450	91,060	5,438,798
	8	170,760	27,780	16.3	142,980	55,004	5,493,802
	9	178,430	32,170	18.0	146,260	63,697	5,557,499
	10	182,330	24,830	13.7	156,500	49,163	5,606,662
	11	173,400	23,800	13.7	149,600	47,124	5,653,786
	12	175,200	21,700	12.4	153,500	42,966	5,696,752
	13	180,400	54,000	29.9	126,400	106,920	5,803,672
	14	195,900	61,500	31.4	134,400	121,770	5,925,442
	15	200,400	50,200	25.0	150,200	99,396	6,024,838
	16	198,200	57,900	29.2	140,300	114,642	6,139,480
	17	174,600	32,200	18.4	142,400	63,756	6,203,236
	18	199,910	50,750	25.4	149,160	100,485	6,303,721
	19	185,950	54,020	29.1	131,930	106,960	6,410,681
	20	185,440	87,410	47.1	98,030	173,072	6,583,753
	21	187,250	56,550	30.2	130,700	111,969	6,695,722
	22	217,710	87,080	40.0	130,630	172,418	6,868,140
	23	229,880	90,260	39.3	139,620	178,715	7,046,855
	24	231,050	79,430	34.4	151,620	157,271	7,204,126
	25	226,100	74,770	33.1	151,330	148,045	7,352,171
	26	195,900	59,560	30.4	136,340	117,929	7,470,100
	27	204,700	84,440	41.3	120,260	167,191	7,637,291
	28	210,370	79,070	37.6	131,300	156,559	7,793,850
	29	223,440	93,440	41.8	130,000	185,011	7,978,861
	30	223,080	80,400	36.0	142,680	159,192	8,138,053

TABLE 2
ROCKY REACH
1982 SPILL CLASSIFICATION

DATE	TOTAL DAILY SPILL (SFD)	FERC SETTLEMENT[1] SPILL (SFD)	ENERGY FORGONE (MWH)	IMMEDIATE[2] ENERGY REPLACEMENT SPILL	POND[3] REGULATION SPILL (SFD)
April 16	47,800	- 0 -	- 0 -	10,417	37,383
17	28,600	- 0 -	- 0 -	14,583	14,017
18	47,600	- 0 -	- 0 -	14,583	33,017
19	42,400	- 0 -	- 0 -	2,083	40,317
20	23,900	2,488	310	14,583	6,829
21	32,800	2,463	285	27,917	2,420
22	16,400	- o -	- 0 -	16,359	41
23	9,242	- o -	- 0 -	9,242	- 0
24	23,890	- 0 -	- o -	23,890	- 0 -
25	18,710	- 0 -	- o -	18,710	- 0 -
26	11,950	2.317	297	9,633	- 0 -
27	14,360	1,013	135	8,750	4,597
28	15,430	8,000	1,062	7,430	- 0 -
29	11,760	11,760	1,606	- 0 -	- 0 -
30	14,820	7,167	957	3,750	3,903
May 1	25,780	- 0 -	- 0 -	24,513	1,267
2	38,570	- 0 -	- 0 -	29,979	8,591
3	39,420	20,516	2,299	16,196	2,708
4	48,900	6,238	513	23,508	19,154
5	42,270	9,900	1,102	23,630	8,740
6	46,240	4,963	521	24,946	15,331
7	36,100	6,133	699	23,554	6,413
a	62,800	- o -	- o -	30,000	32,800
9	78,100	- o -	- o -	30,000	48,100
10	42,700	19.754	2,162	9,942	13,004
11	21,700	10,083	1,273	7,358	4,259
13	17,400	10,204	1,307	7,196	- 0 -
14	29,400 21,800	11,929	1,477	9,833	38
		8,517	1,031	20,883	- 0 -
15	48,800	- 0 -	- o -	29,908	18,892
16	55,700	- o -	- 0 -	29,983	25,717
17	76,800	6,204	533	23,750	46,846
18	83,200	8,508	649	51,721	22,971
19	93,500	7,488	548	54,321	31,691
20	99,900	6,238	443	54,608	39,054
21	a2,080	12,492	1,031	35,620	33,968
22	59,030	19,920	1,931	26,145	12,965

T. 2
(Continued)

DATE		TOTAL DAILY SPILL (SFD)	FERC SETTLEMENT[1] SPILL (SFD)	ENERGY FORGONE (MWH)	IMMEDIATE[2] ENERGY REPLACEMENT SPILL (SFD)	POND[3] REGULATION SPILL (SFD)
May	23	81,860	- 0 -	- 0 -	48,696	33,164
	24		22,429	2,110	19,550	23,191.
	25	65,170 93,975	10,000	720	32,500	51,475
	26	82,080	22,513	1,848	20,000	39,567
	27	81,820	8,750	701	28,333	44,737
	28	105,390	8,658	578	29,583	67,149
	29	126,550	- o -	- o -	75,771	50,779
	30	128,950	- o -	- o -	79,916	49,034
	31	90,910	6,250	453	38,333	46,327
		2,366,557	282,895	28,581	1,142,206	941,456

1. FERC Settlement Spili is spill requested by the Designated Representatives for juvenile salmonid passage. This spill was not for pond regulation and no replacement energy was provided from the federal system, thus the District and its purchasers lost the power that could have been generated from the water spilled. The volume of FERC settlement spill allocated for the 1982 season was 389,170 SFD (769,000 AF) at Rocky Reach Dam (includes Supplemental quota).

2. Immediate Energy Replacement Spill is spill for which the District received electrical energy from the federal system equivalent to the amount that Rocky Reach Dam could have produced with the volume of water spilled. This spill was shifted from federal dams to Rocky Reach in order to improve juvenile fish passage at dams where the migration was passing and to reduce dissolved gas levels in the lower Columbia River.

3. Pond Regulation Spill occurred when the stream flow exceeded the hydraulic capacity of the powerhouse.

TABLE 3
ROCK ISLAND SPILL
FISH FLOW 1982

DATE	STREAM FLOW (SFD)	DAILY SPILL (SFD)	%STREAM FLOW SPILLED	TURBINE DISCHARGE (SFD)	DAILY SPILL (ACRE-FEET)	ACCUMULATED SPILL (ACRE-FEET)
April 16	176,100	- 0 -	- 0 -	175,100	- 0 -	- 0 -
17	168,600	21,400	12.7	145,900	42,372	42,372
18	178,300	24,500	13.7	152,600	48,510	90,882
19	186,700	20,100	10.8	165,400	39,798	130,680
20	155,900	20,100	12.9	134,600	39,798	170,478
21	148,800	37,100	24.9	110,400	73,458	243,936
22	141,600	53,300	37.6	87,000	105,534	349,470
23	140,630	32,890	23.4,	106,530	65,122	414,592
24	122,410	68,320	55.8	52,680	135,274	549,866
25	113,910	30,860	27.1	81,720	61,103	610,969
26	128,010	23,060	18.0	103,740	45,659	656,628
27	130,530	38,150	29.2	91,130	75,537	732,165
28	131,180	40,690	31.0	89,210	80,566	812,731
29	117,810	18,260	15.5	98,360	36,155	848,886
30	130,470	17,550	13.6	111,740	34,749	883,635
May 1	126,010	66,180	52.5	58,420	131,036	1,014,671
2	153,180	79,510	51.9	72,170	157,430	1,172,100
3	168,050	45,610	27.1	121,050	90,308	1,262,408
4	162,100	68,800	42.4	91,800	136,224	1,398,632
5	159,940	89,490	56.0	68,950	177,190	1,575,822
6	160,410	91,160	56.8	67,740	180,497	1,756,319
7	156,850	89,430	57.0	66,950	177,071	1,933,390
8	179,200	100,000	55.8	77,700	198,000	2,131,390
9	180,800	101,400	56.1	77,900	200,772	2,332,162
10	183,400	68,200	37.2	113,700	135,036	2,467,198
11	163,700	59,500	36.3	102,700	117,810	2,585,008
12	158,300	67,700	42.8	89,200	134,046	2,719,054
13	160,200	77,700	48.5	81,000	153,846	2,872,900
14	146,600,	67,000	45.7	78,100	132,660	3,005,560
15	162,300	96,200	59.3	64,600	190,476	3,196,036
16	172,600	100,200	58.1	70,800	198,396	3,394,432
17	188,800	74,500	39.5	112,800	147,510	3,541,942
18	184,300	83,400	45.3	99,400	165,132	3,707,074
19	197,100	53,800	27.3	142,000	106,524	3,813,598
20	198,100	88,400	44.6	108,100	175,032	3,988,630
21	194,410	80,960	41.6	111,950	160,301	4,148,931
22	185,740	68,060	36.6	116,180	134,759	4,283,690
23	191,540	85,000	44.4	105,040	168,300	4,451,990
24	196,520	67,680	34.4	127,340	134,006	4,585,996
25	194,600	73,880	38.0	119,230	146,232	4,732,278
26	197,520	55,080	27.9	140,980	109,058	4,841,336
27	189,500	51,660	27.3	136,510	102,287	4,943,623

T. 3
(Continued)

DATE		STREAM FLOW (SFD)	DAILY SPILL (SFD)	%STREAM FLOW SPILLED	TURBINE DISCHARGE (SFD)	DAILY SPILL (ACRE-FEET)	ACCUMULATED SPILL (ACRE-FEET)
May	28	200,700	58,620	29.2	140,680	116,068	5,059,690
	29	184,290	93,570	50.8	89,220	185,269	5,244,959
	30	183,150	100,540	54.9	81,110	199,069	5,444,028
	31	182,950	54,310	29.7	127,220	107,534	5,551,562
June	1	186,840	19,190	10.3	166,390	37,996	5,589,558
	2	189,770	30,680	16.2	157,740	60,746	5,650,304
	3	188,430	30,310	16.1	156,730	60,014	5,710,318
	4	189,250	34,100	18.0	153,780	67,518	5,777,836
	5	172,760	28,330	16.4	143,130	56,093	5,833,929
	6	159,740	67,420	42.2	90,820	133,492	5,967,421
	7	182,950	35,450	19.4	146,150	70,191	6,037,612
	8	174,410	25,790	14.8	147,360	51,064	6,088,676
	9	176,040	19,630	11.2	155,100	38,867	6,127,543
	10	182,230	13,190	7.2	167,840	26,116	6,153,659
	11	178,900	13,700	7.7	163,900	27,126	6,180,785
	12	181,500	12,300	6.8	168,000	24,354	6,205,139
	13	185,700	48,800	26.3	135,300	96,624	6,301,763
	14	197,800	28,000	14.2	168,400	55,440	6,357,203
	15	204,800	55,700	27.2	147,700	110,286	6,467,489
	16	202,100	60,100	29.7	140,500	118,998	6,586,487
	17	185,300	37,900	20.5	145,900	75,042	6,661,529
	18	202,930	58,230	28.7	143,200	115,295	6,776,824
	19	189,580	46,690	24.6	141,400	92,446	6,869,270
	20	189,600	114,990	60.6	73,110	227,680	7,096,950
	21	189,800	50,440	26.6	137,930	99,871	7,196,821
	22	217,170	83,160	38.3	132,570	164,657	7,361,478
	23	225,710	85,680	38.0	138,520	169,646	7,531,124
	24	229,850	80,430	35.0	147,920	159,251	7,690,375
	25	224,450	69,940	31.2	153,020	138,481	7,828,856
	26	198,390	45,120	22.7	151,770	89,338	7,918,194
	27	204,020	95,160	46.6	107,360	188,417	8,106,611
	28	207,000	70,260	33.9	135,250	139,115	8,245,726
	29	219,500	91,520	41.7	126,470	181,210	8,426,936
	30	219,050	67,100	30.6	150,450	132,858	8,559,794

TABLE 4
ROCK ISLAND
1982 SPILL CLASSIFICATION

DATE	TOTAL DAILY SPILL (SFD)	FERC SETTLEMENT1 SPILL (SFD)	ENERGY FORGONE (MWH)	IMMEDIATE[2] ENERGY REPLACEMENT SPILL (SFD)	POND[3] REGULATION SPILL (SFD)
April 16	- O -	- O -	- 0 -	- O -	- c -
17	21,400	7,758	404	13,642	- 0 -
18	24,500	7,783	390	16,667	50
19	20.100	9,738	498	10,362	- 0 -
20	20,100	7,646	409	2,083	10,371
21	37,100	- 0 -	- 0 -	37,100	- 0 -
22	53,300	- 0 -	- 0 -	53,300	- 0 -
23	32,890	1,492	72	30,833	565
24	68,320	- O -	- 0 -	68,320	- 0 -
25	30,860	- O -	- 0 -	29,130	1,730
26	23,060	3,033	164	20,027	- 0 -
27	38,150	1,683	78	29,166	7,301
28	40,690	16,000	710	24,690	- 0 -
29	18,260	18,260	1,048	- 0 -	- 0 -
30	17,550	1,190	67	6,563	9,797
May 1	66,180	- 0 -	- 0 -	59,809	6,371
2	79,510	- 0 -	- 0 -	79,393	117
3	45,610	9,663	424	34,514	1,433
4	68,800	12,508	432	54,580	1,712
5	89,490	10,388	282	78,654	448
6	91,160	8,292	223	82,504	364
7	89,430	10,558	274	78,633	239
8	100,000	- 0 -	- 0 -	99,829	171
9	101,400	- 0 -	- 0 -	100,000	1,400
10	68,200	29,575	1,107	33.583	5,042
11	59,500	25,854	999	33; 192	454
12	67,700	16,721	622	47,917	3,062
13	77,700	21,308	711	56,054	338
14	67,000	15,250	556	51,150	600
15	96,200	1,654	44	93,488	1,058
16	100,200	- 0 -	- 0 -	99,963	237
17	74,500	10,362	405	63,529	609
18	83,400	18,833	651	62,258	2,309
19	53,800	16,379	743	37,150	271
20	88,400	10.417	360	701354	7,629
21	80,960	12,371	448	64,450	4,139
22	68,060	33,450	1,333	33,367	1,243

T. 4
(Continued)

DATE		TOTAL DAILY SPILL (SFD)	FERC SETTLEMENT[1] SPILL (SFD)	ENERGY FORGONE (MWH)	IMMEDIATE[2] ENERGY REPLACEMENT SPILL (SFD)	POND[3] REGULATION SPILL (SFD)
May	23	85,000	- 0 -	- 0 -	76,942	8,058
	24	67,680	37,579	1,533	24,992	5,109
	25	73,880	16,588	645	45,833	11,459
	26	55,080	16,363	719	24,700	14,017
	27	51,660	- 0 -	- 0 -	41,454	10,206
	28	58,620	- 0 -	- 0 -	45,833	12,787
	29	93,570	- 0 -	- 0 -	93,570	- 0 -
	30	100,540	- 0 -	- 0 -	100,000	540
	31	54,310	- 0 -	- 0 -	54,167	143
		2,803,820	408,696	16,351	2,263,745	131,379

1. FERC Settlement Spill is spill requested by the Designated Representatives for juvenile salmonid passage, This spill was not for pond regulation and no replacement energy was provided from the federal system, thus the District and its' purchasers lost the power that could have been generated from the water spilled. The volume of FERC settlement spill allocated for the 1982 season was 384,109 SFD (758,998 AF) at Rock Island Dam (includes Supplemental quota).

2. Immediate Energy Replacemnt Spill is spill for which the District recieved electrical energy from the federal system equivalent to the amount that Rock Island Dam could have produced with the volume of water spilled. This spill was shifted from federal dams to Rock Island in order to improve juvenile fish passage at dams where the migration was passing and to reduce dissolved gas levels in the lower Columbia River.

3. Pond Regulation Spill occurred when the streamflow exceeded the hydraulic capacity of the powerhouse.

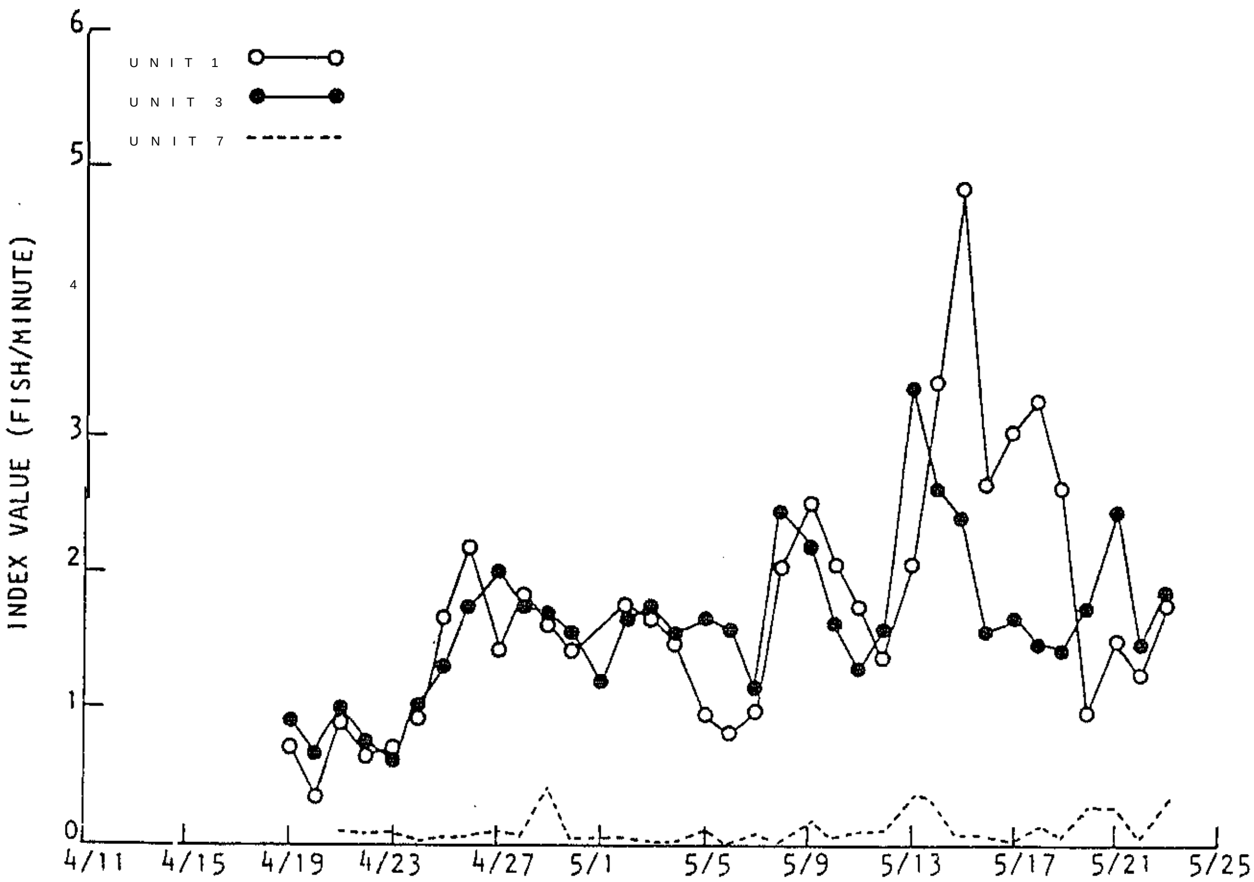


Figure 1. Daily fish passage indices for Units 1, 3, and 7 at Rocky Reach Dam during the 1982 spring migration. (Biosonics, 1982).

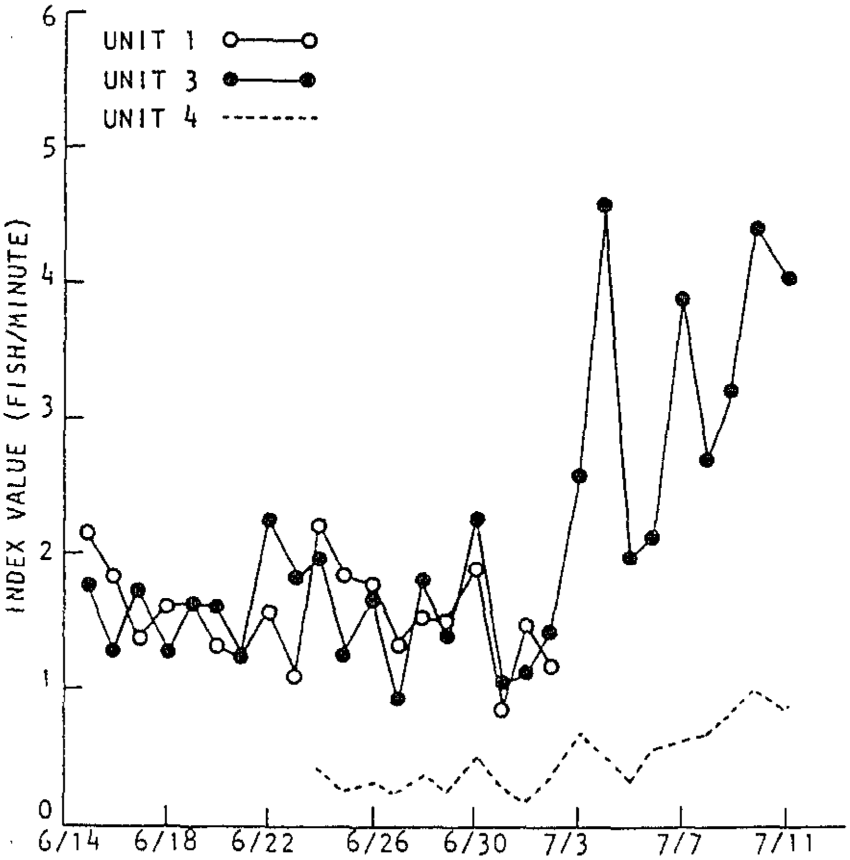


Figure 2. Daily fish passage indices for Units 1, 3, and 4 at Rocky Reach Dam during the 1982 summer migration. (Biosonics, 1982).

1982 ROCKY REACH SEAGULL COUNT

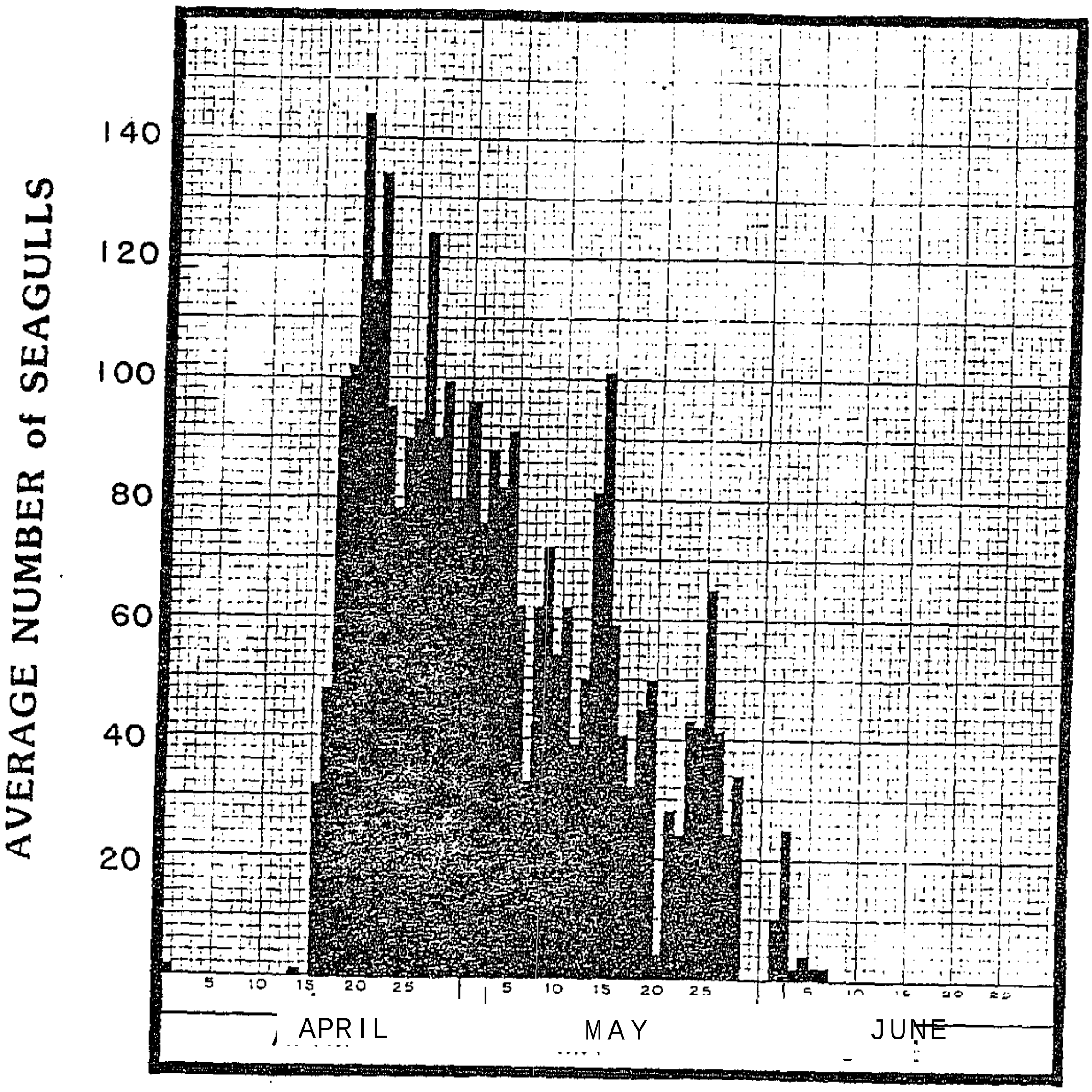


Figure 3. Daily seagull count in the Rocky Reach tailrace during 1982.

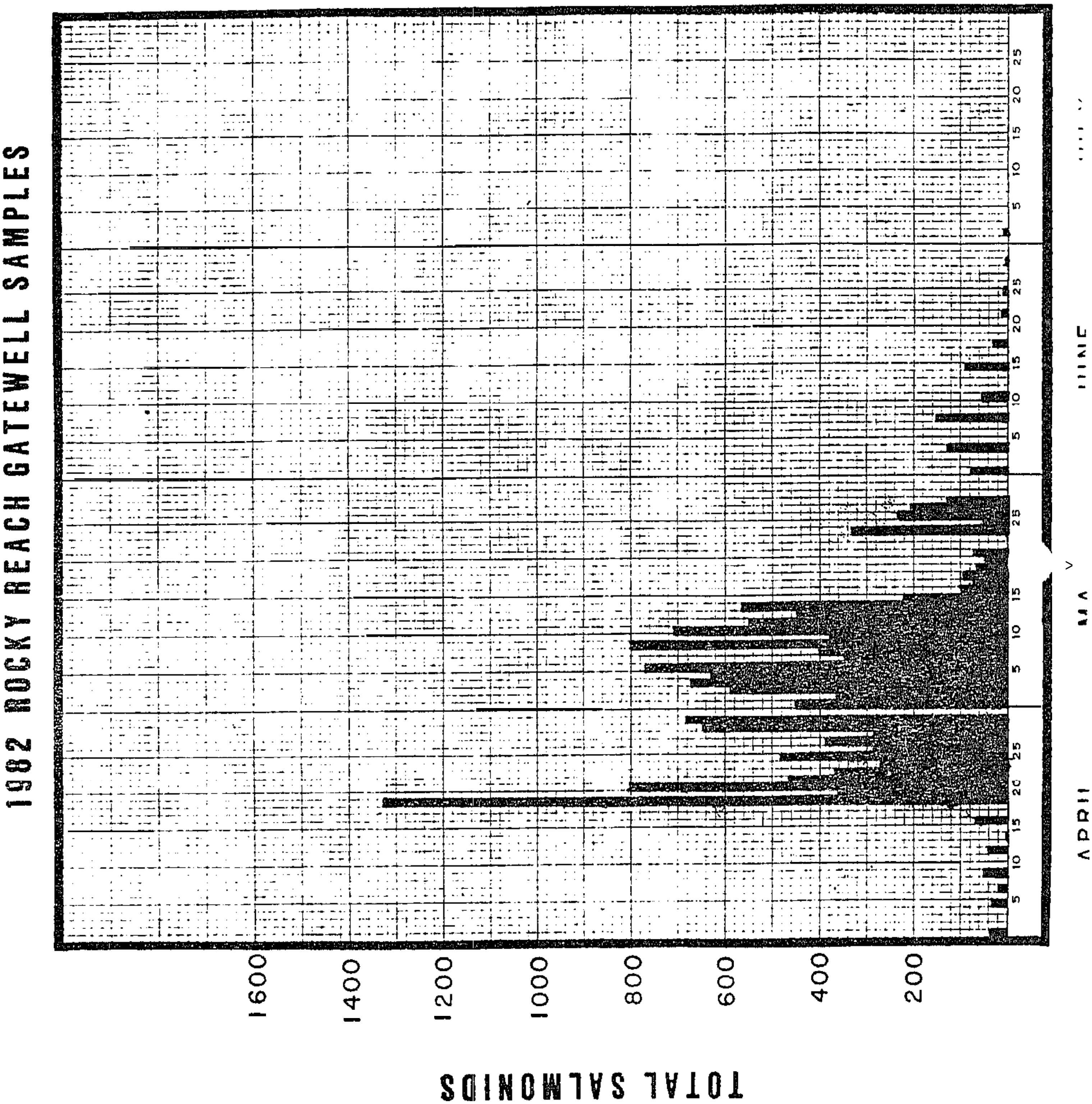


Figure 4. Number of juvenile salmonids removed from Rocky Reach Unit 1 gatewell A during the 1982 migration.

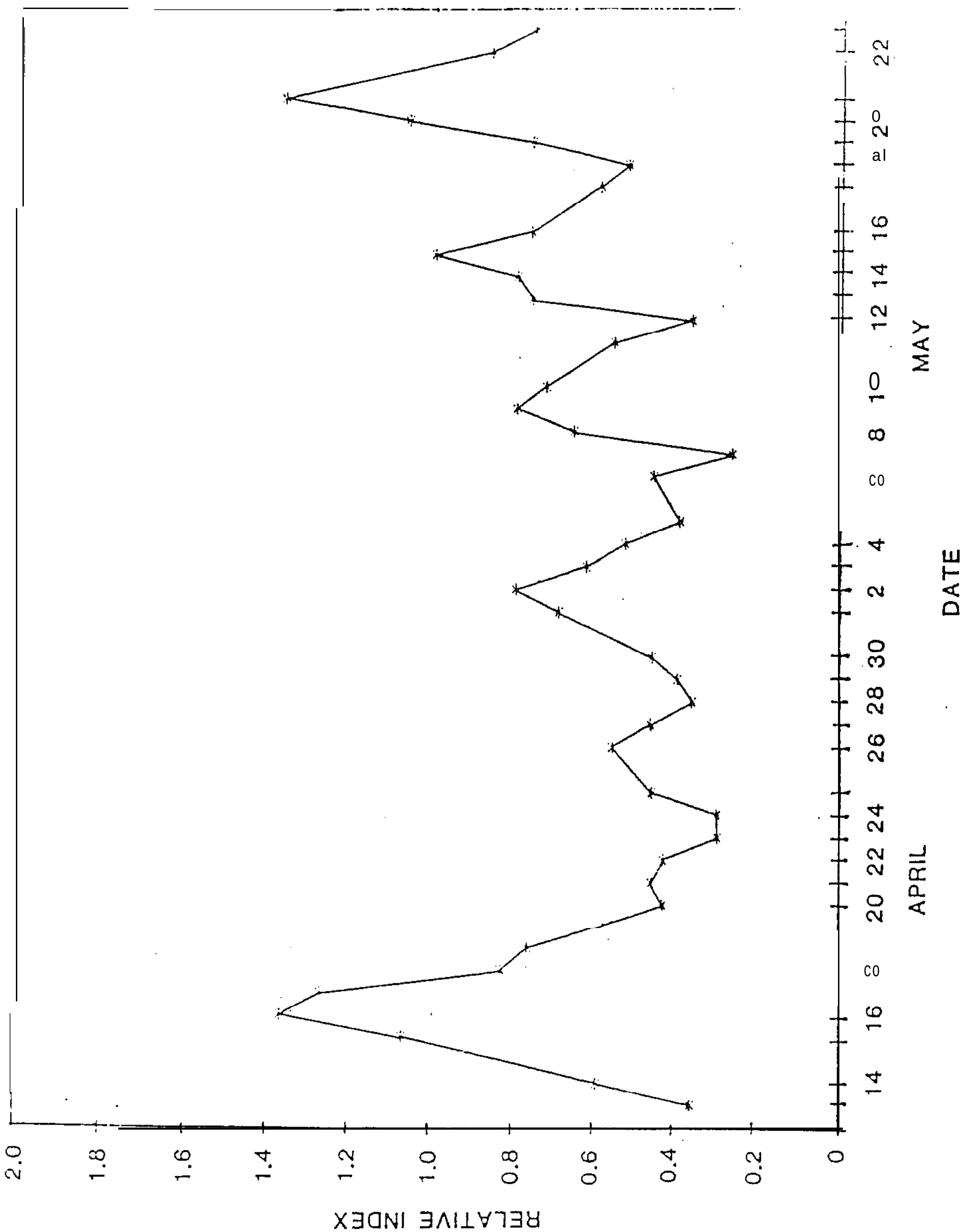


Figure 5. Daily fish passage combined index for Units 1 and 5 at Pock Island Dam during the 1982 spring migration. (Biosonics, 1982).

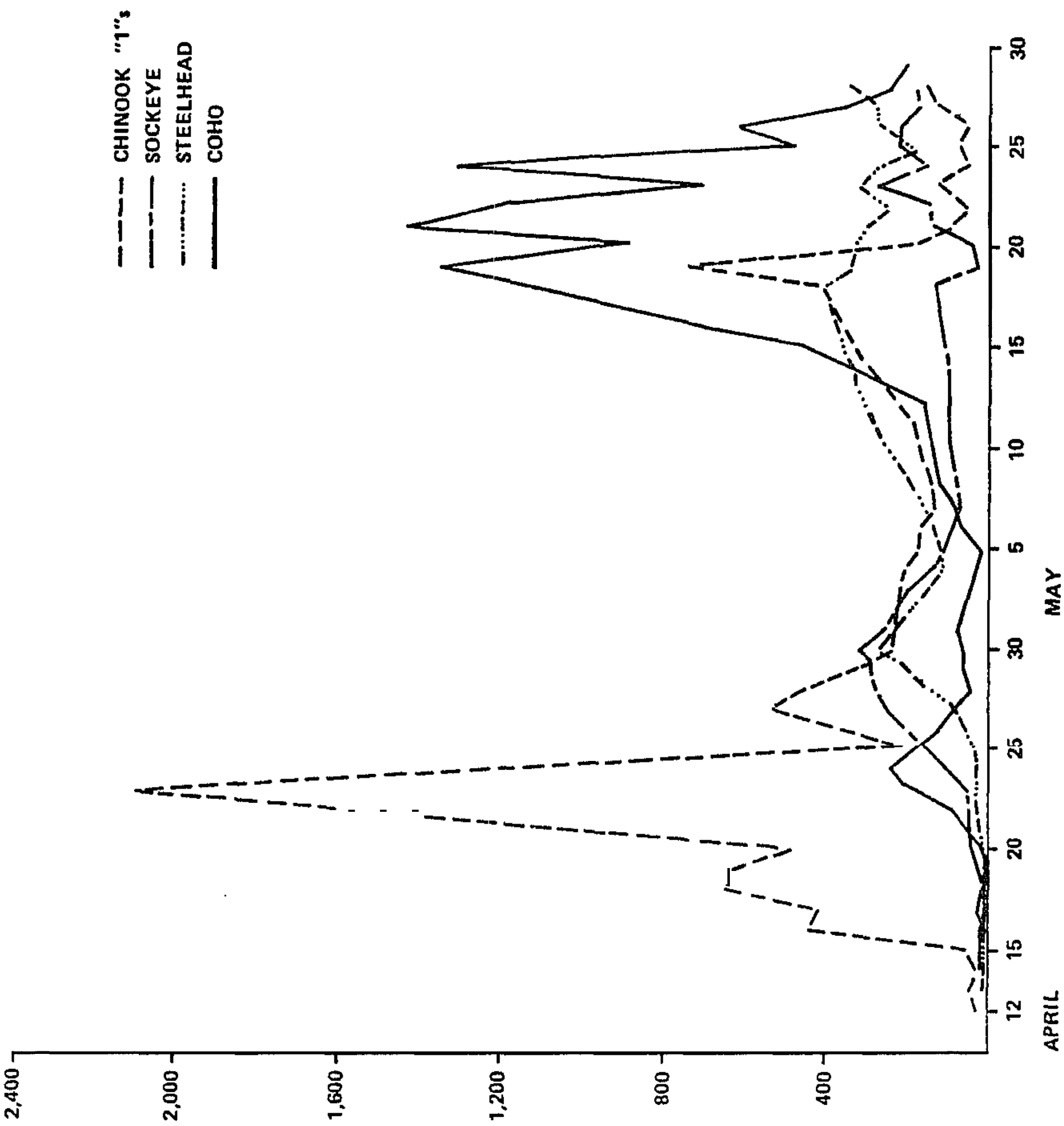


Figure 6. Estimated number of juvenile salmonids using the Rock Island fingerling bypass during the 1982 spring migration. (CH2M Hill, 1982).

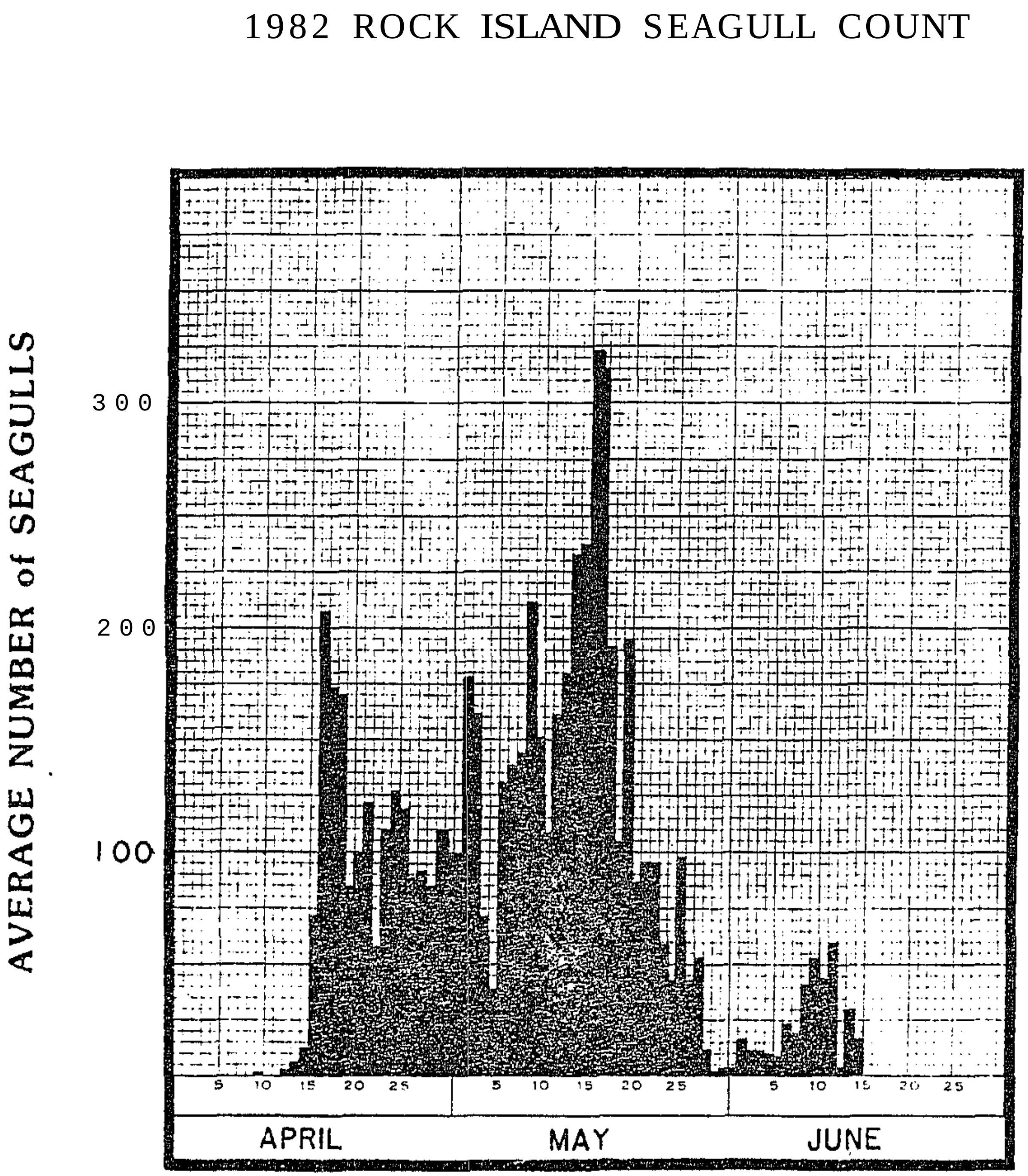


Figure 7. Daily seagull count in the Rock Island tailrace during 1982.

SUMMARY DATA FROM PUBLIC UTILITY DISTRICT NO. 2 OF GRANT COUNTY ON FISH FLOW 1982 IN THE MID-COLUMBIA

The following report summarizes the District's fisheries studies, gatewell monitoring and flow/spill manipulation to pass juvenile migrant salmonids during the spring of 1982. Special hydroacoustic studies were conducted at Priest Rapids and Wanapum Dams to estimate horizontal and vertical distribution of migrants in the forebay, turbine intakes, spillways, diel passage and effectiveness of spill.

WATER CONDITIONS. The water year of 1952 has provided well above normal runoff especially during March when flows past Priest Rapids Dam averaged 200,000 cfs. The water year as of March 1, 1982 for the Mid-Columbia inflow was forecast to be 116% of normal. Spill began February 26 at Priest Rapids and Wanapum Dams and continued through July 31.

SPILL PLAN. Abatement spill from BPA was provided at Priest Rapids from April 12 through July 17 and from April 15 through July 17 at Wanapum Dam. For 1982, the following spill procedures were implemented:

> A Detailed Fishery Operating Plan (DFOP) for protection of downstream migrations of juvenile salmon and steelhead in 1982 was drafted by the fishery agencies and reviewed by the utilities. Spill at our Mid-Columbia dams was influenced by BioSonics, Inc. hydroacoustic studies, gull counts and Parametrix and District gatewell sampling.
>
> For hydroacoustic studies and gatewell sampling it was important to operate units 4, 6 and 7 at Priest Rapids. Transducers were stationed on pier mounts in front of units 2, 4, 6, 8 and 10 at Wanapum while gatewell samples included B slot in all 10 units. Actual control of spill was under the jurisdiction of the agency and utility designated representatives.

PRIEST RAPIDS

Preferred Time	Preferred Spill Gates	Spill CFS	REMARKS:
Not Specified, but probably 2200 - 0600	10,11,12,13	Spill through 1 to 4 gates depending on amount	NO Sluice Gate Skim Spill -- Designated representatives will determine level of deep spill each afternoon and notify Dispatching.

WANAPUM

Preferred Time	Preferred Spill Gates	Spill CFS	REMARKS:
Not Specified, but probably 2200 - 0600	8,9,10,11,12	Spill through 1 to 5 gates depending on amount	Designated representatives will determine level of deep spill each afternoon and notify Dispatching.
2000 - 0800	Sluice Gate	2,000 - 3,000 cfs Varies with forebay elevation.	Surface sluice gate spill is part of the total daily spill.

If spill exceeded gate capacities, additional spill was provided through gates on each side of the preferred gates.

SPILL AMOUNTS AT DISTRICT DAMS. The flow requested by fishery agencies was 140,000 cfs on a weekly average in 1982. The 1982 spill allotment for the FERC Settlement Agreement was 780,000 acre feet. The 30-day FERC spill period at Priest Rapids and Wanapum Dams was May 3 - June 2. In a memo dated May 28 from the agency designated representatives, a supplemental spill period was requested for June 3 - June 16 at the two dams.

The following levels of spill and flow were attained at District Projects:

Date	Dam	Type of Spill in Acre Feet		
		N_2	FERC Plus Inadvertant	Total
5/1-31	Priest Rapids	4,857,028	2,601,418	7,458,446
6/1-16	Priest Rapids	1,497,508	1,276,178	2,773,686
		6,354,536	3,877,596	10,232,132
5/1-31	Wanapum	3,546,940	3,001,490	6,548,430
5/1-16	Wanapum	1,014,049	1,715,207	2,729,256
		4,560,989	4,716,697	9,277,686

Date	Dam	Daily Avg. Flow in KCFS		
		Total Discharge	spill	% Spill
5/1-31	Priest Rapids	190.4	121.3	63.7
6/1-16	Priest Rapids	193.8	87.4	45.1
5/1-31	Wanapum	180.8	106.5	58.9
6/1-16	Wanapum	185.6	86.0	46.3

An example of the high level of spill attained is given for Priest Rapids for eight hours (2200-0600) each night in the 47-day period (May 1 - June 16, 1982):

Level of Spill to Total Discharge:	60%	70%	75%	80%	85%
Number of Days:	42	35	32	25	8

The heavy spill encountered in 1982 caused damage to hydroacoustic gear at Priest Rapids in early May. On May 4, spill gate 12 broke during heavy spill and slammed shut. This gate remained out of service for the remainder of the spill season.

Total dissolved gas levels were monitored periodically from April 24 to June 29. The TDG levels measured in the Priest Rapids forebay ranged from 106 to 128 percent.

MONITORING OF JUVENILE SALMONID MIGRATION. Gatewells were sampled daily at Priest Rapids by Parametrix and District personnel from April 23 to June 4. Eight selected gatewells at Priest Rapids'were used for indexing juvenile smolt migrations, and study plans were coordinated through the FERC Studies Committee.

A reduced sampling effort will continue into September (three to five days per week). Gatewell catches for the spring migration period were as follows:

	Chinook	Steelhead	Coho	Sockeye	Total All Species
PRIEST RAPIDS	18,877	2,202	209	8,237	29,525

Bulkhead (upstream) gatewells were sampled daily at Wanapum by Parametrix and District personnel from April 24 to June 4. Ten center gatewells (one for each unit) were sampled for juvenile salmonid smolts. The failure of a unit reduced the sampling effort to nine gatewells partway through the season. Gatewell catches for the spring migration period were as follows:

	Chinook	Steelhead	Coho	Soc keye	Total All Species
WANAPUM	13,379	1,172	158	2,580	17,289

Seagull counts were recorded for 0800, 1200 and 1700 hours from April 15 through June 30. Peaks in gull observations occurred on April 29, May 5, 19, 23 and 27 (Figure 1). In contrast, the peak gatewell catch at Wanapum was on April 28 and on May 4 at Priest Rapids. The major peak of gull counts on May 19 is probably a better indicator of peak juvenile salmonid passage than the gatewell catches. As total flow and spill increased through May, the gatewell catches continued to decline from a peak in early May at Priest Rapids (Figure 2). Previous gatewell sampling at Priest Rapids from 1976 through 1981 indicated peak dates between May 12 and 19 each year. Figure 3 is included for comparison with pervious COFO reports.

Wanapum peak gatewell catches on April 28, May 15 and 18 were similar to Priest Rapids, but were not directly comparable due to the use of emergency gatewells at Priest Rapids and bulkhead gatewells at Wanapum (Figure 4).

FERC SPRING STUDIES. Spring studies conducted in 1982 (third year of settlement agreement) continued to emphasize horizontal and vertical distribution, and abundance and approach patterns of downstream migrating juvenile salmonids at Mid-Columbia dams. The following is a list of Grant County PUD studies initiated, participated in, or completed in 1982. The Studies Committee conducted separate meetings with each PUD and the list of studies for other PUD's is not included.

1. Gatewell Monitoring at Priest Rapids and Wanapum - PMX, GPUD
2. Hydroacoustic Studies at Priest Rapids - BioSonics, GPUD
3. Hydroacoustic Studies at Wanapum - BioSonics, GPUD
4. System Mortality Test - 1982 (Joint PUD's) - Chapman, PMX, BNW
5. Physiological Monitoring of SMT Fish (Joint PUD's) - PMX

FERC VERNITA BAR STUDIES. This marked the third year of Vernita Bar studies under the Settlement Agreement. Studies were concentrated on impacts of flow fluctuations on spawning, redd exposure, egg and fry survival and emergence. Ongoing activities were environmental conditions, aerial redd counts and aerial photography. The continued assistance of water management groups under COFO during critical flow periods is an important part of the study effort.

Individuals who represented Grant County PUD at COFO meetings in 1982 were:

Carl A. Barr, Director of Power Production
Al E. Wright, Environmental Supervisor
Michael B. Dell, Biologist

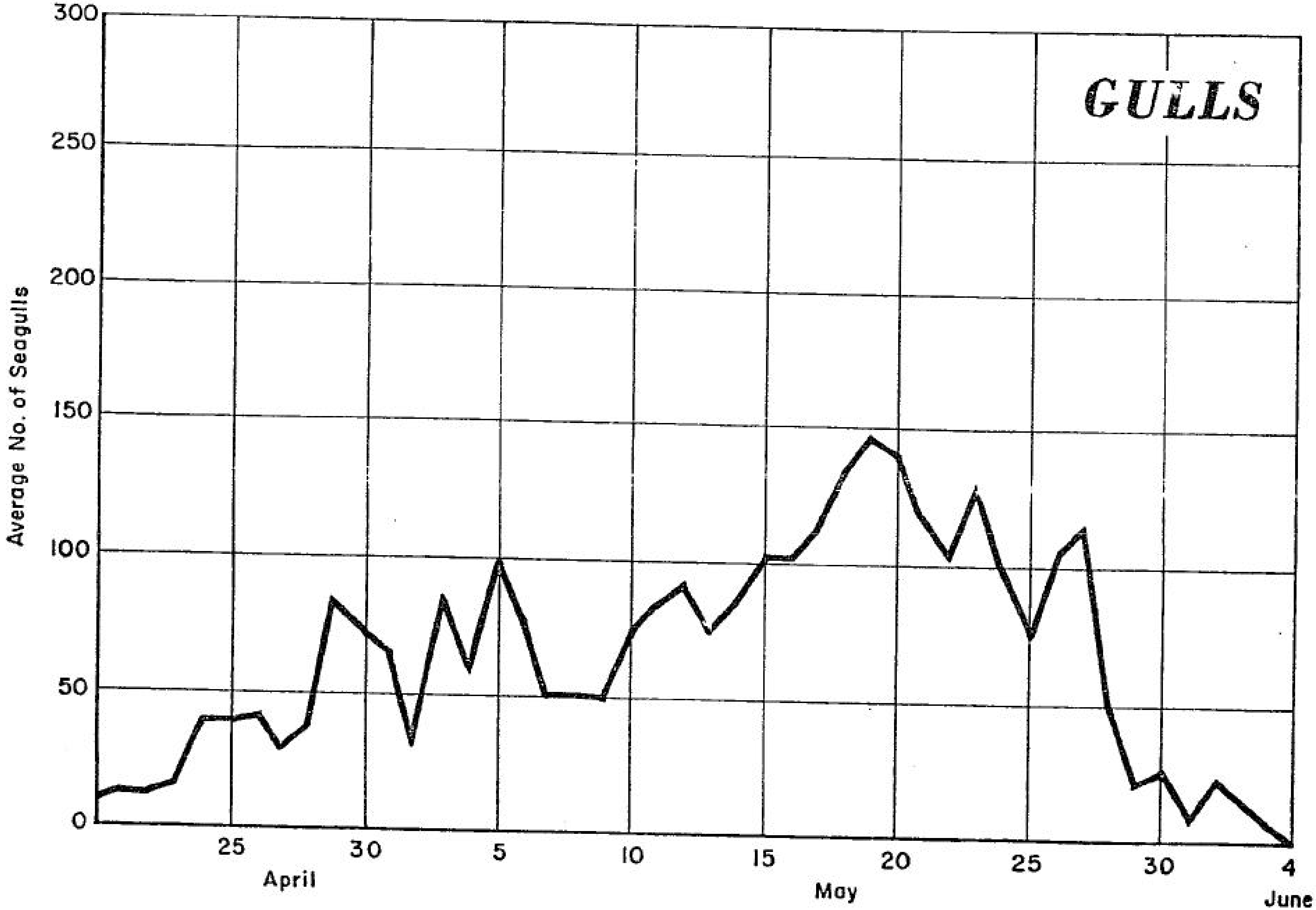


Fig. 1 1982 Seagull Counts below Priest Rapids Dam

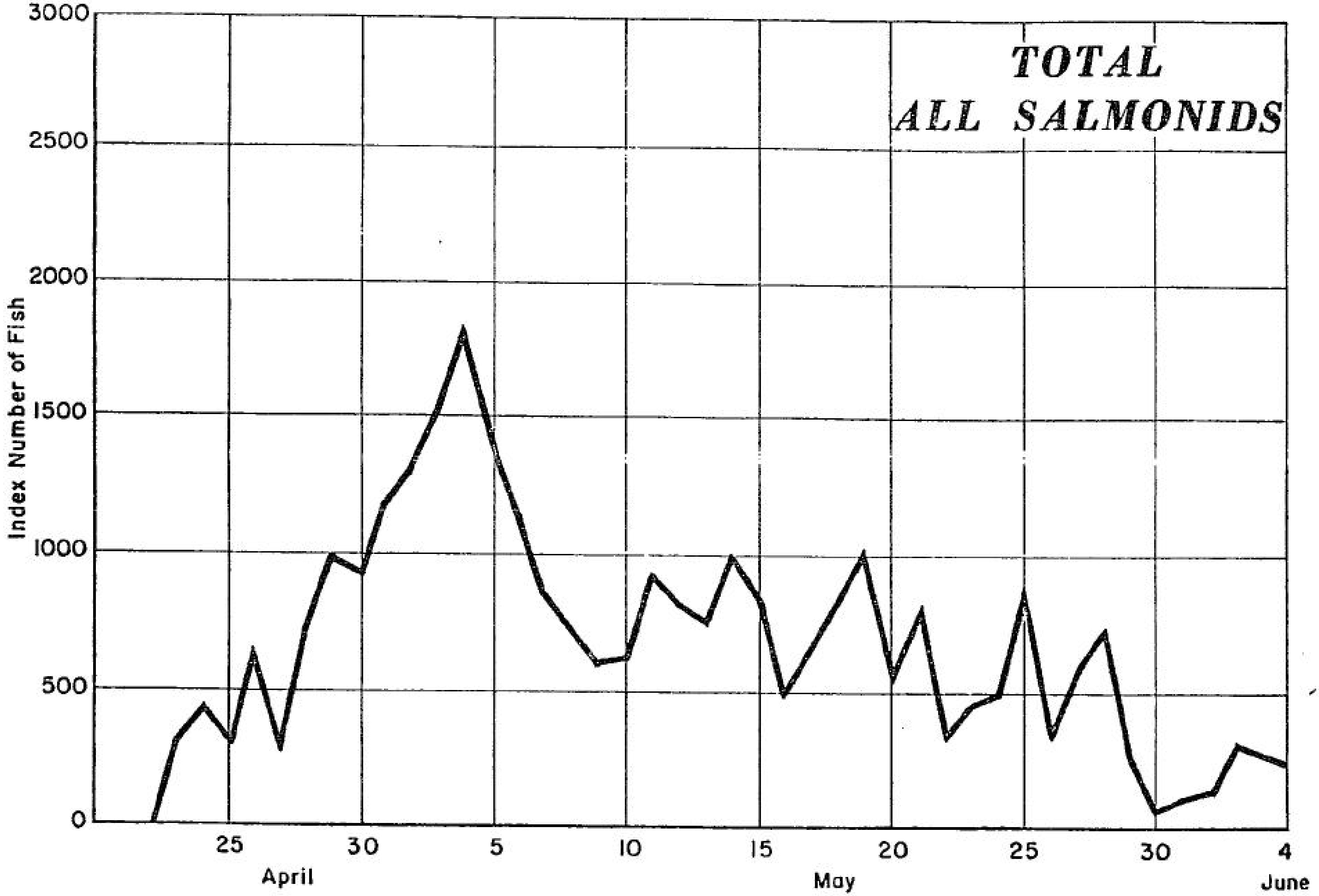


Fig. 2 Total Catch of Juvenile Salmonids in Priest Rapids Gatewells in 1982

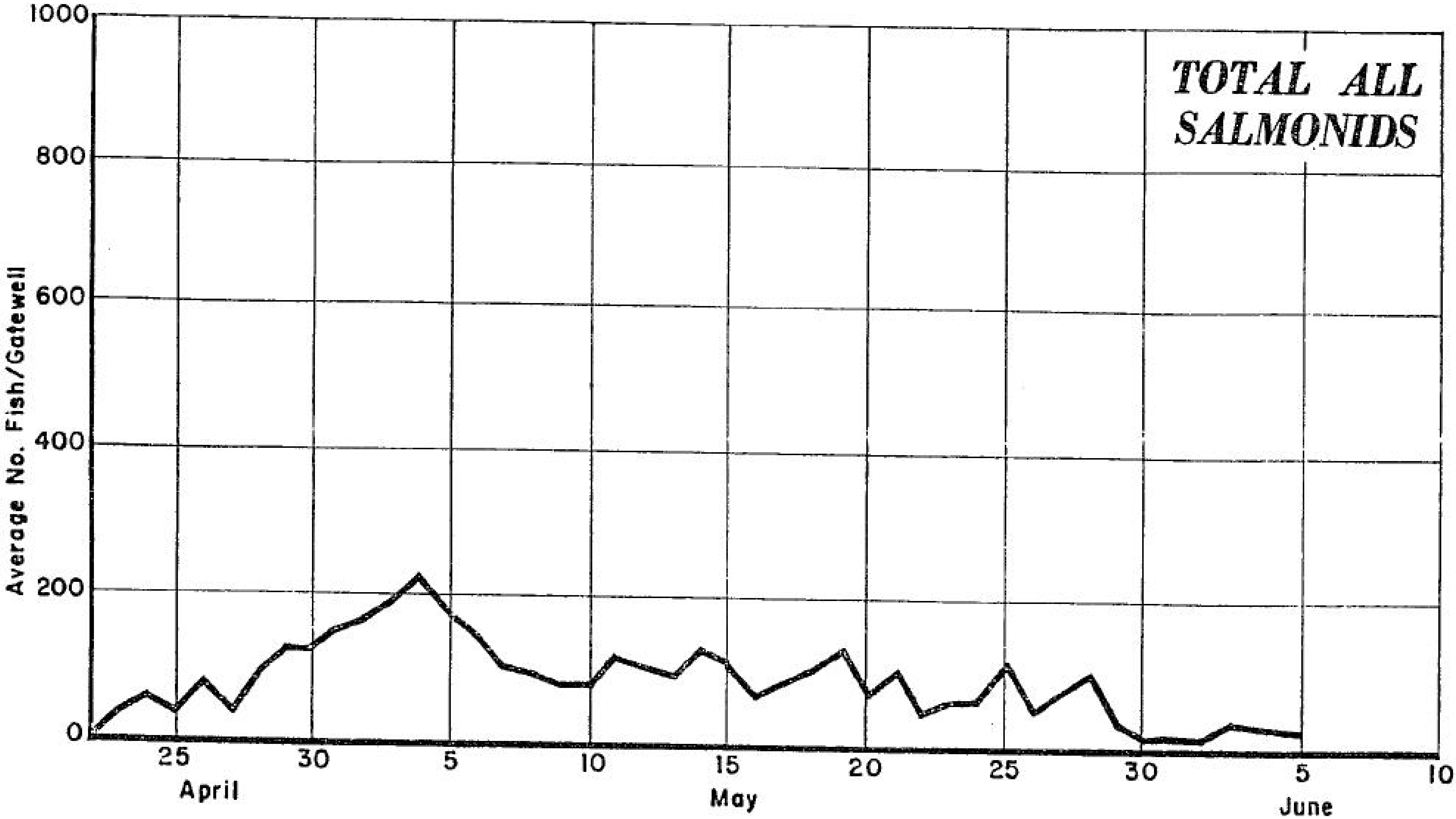


Fig. 3 AVERAGE CATCH PER TURBINE GATEWELL BY DAY AT PRIEST RAPIDS DAM IN 1982

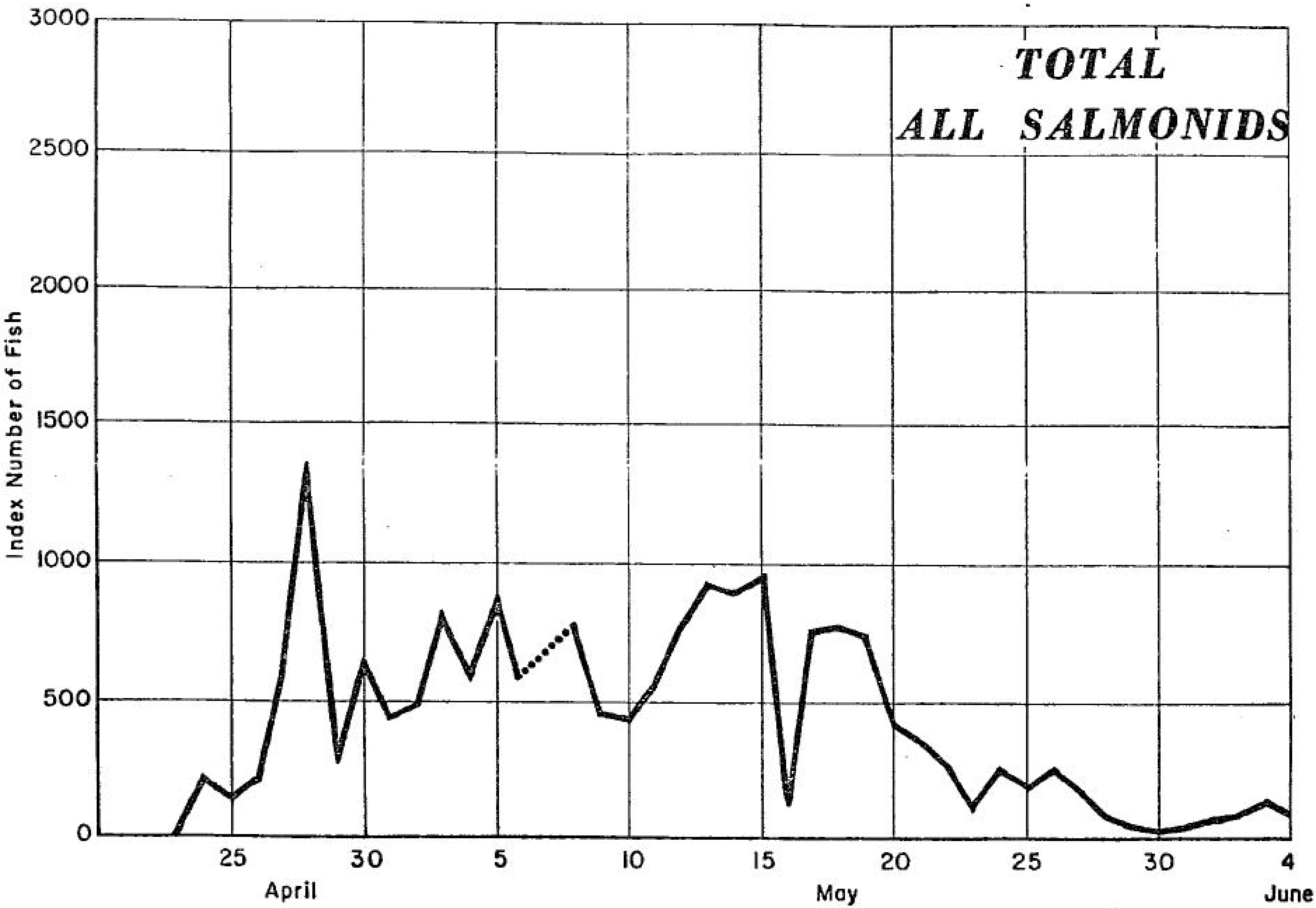


Fig. 4 Total Catch of Juvenile Salmonids in Wanapum Gatewells in 1982

Appendix VIII TCHRY

DEPARTMENT OF THE ARMY
NORTH PACIFIC DIVISION. CORPS OF ENGINEERS
P.O. BOX 2870
PORTLAND. OREGON 97208

NPDEN-WM

16 December 1982

RECEIVED

DEC 2 ? 1982

Mr. Terry Holubatz
Columbia Basin Fish and Wildlife Council
Suite 1240 - Lloyd Building
700 N.E. Multnomah Avenue
Portland, OR 97232

Dear Mr. Holubetz:

Inclosed for your information is a copy of our 1982 Dissolved Gas Monitoring Program Report. The monitoring was requested by the fishery agencies and it covers the period of 14 April to 3 August 1982.

Sincerely,

Nicholas A Dodge

NICHOLAS A. DODGE
Chief, Water Management Branch

1 Incl
as

THE 1982
DISSOLVED GAS MONITORING PROGRAM
REPORT

U. S. ARMY CORPS OF ENGINEERS
NORTH PACIFIC DIVISION
WATER MANAGEMENT BRANCH
WATER QUALITY SECTION

DECEMBER 1982

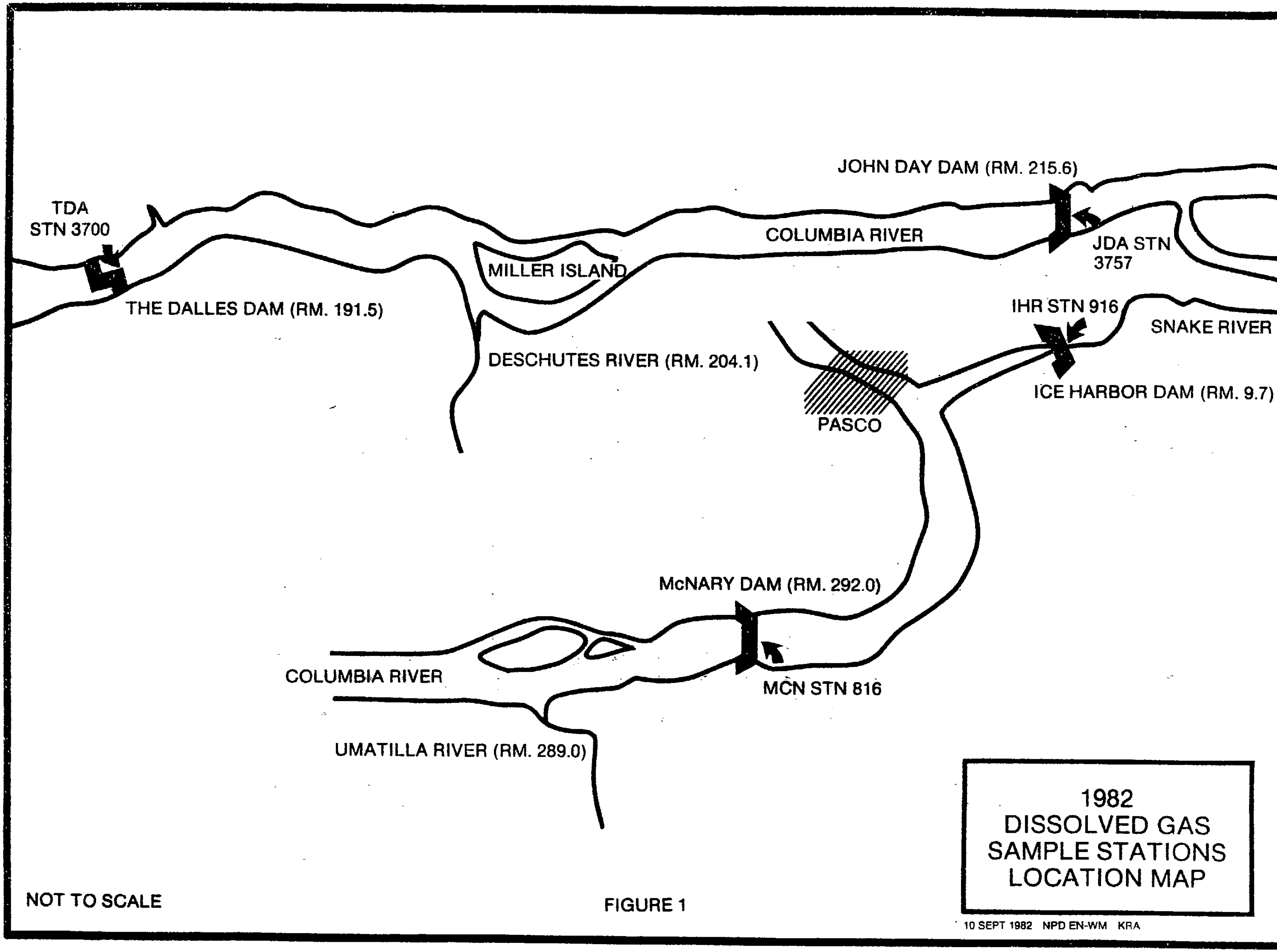
INTRODUCTION

The 1982 dissolved gas monitoring program was implemented by the North Pacific Division's Water Management Branch at the request of the fishery agencies. "In situ" measurements of dissolved gas, dissolved oxygen and water temperature were taken at four projects on the Lower Snake and Columbia Rivers. The entire operation was managed by the Water Quality Section from 14 April to 3 August 1982. Two data parameters (dissolved gas pressure/water temperature) were collected and recorded by using portable Tensionometers equipped with a recorder at each site. Dissolved oxygen data was read from a YSI DO meter only at Ice Harbor Dam. All the instruments were placed at forebay locations at Ice Harbor, McNary, John Day, and The Dalles Projects (see Figure 1). During the monitoring program, technicians and/or powerhouse operators at the four dams recorded periodic tensionometer digital readings for total dissolved gas pressure/percent and water temperature. This daily information was made available by the Water Quality Section to the Reservoir Control Center and the "Fish Smolt Coordinator" for guidance in coordinating the spill at various projects involved in the downstream fish movement.

THE DISSOLVED GAS MONITORING PROGRAM

The monitoring program was initially designed to take continuous parameter measurements throughout the projected downstream fish migration period. As in previous years the John Day Dam was the primary fishery concern of all the Columbia River Basin System Projects because large amounts of spill at this particular project can create a potential for high downstream dissolved gas percentages. Initial 1982 COFO plans called for controlled concentrated spills at the John Day Dam to provide juvenile fish passage with monitoring at John Day and The Dalles to determine the amount of dissolved gas percentages created by the spill. However, the high flows throughout the basin and the early involuntary spill conditions that resulted, provided more than adequate spills for fish passage. Higher spills and total flows were experienced this year at Ice Harbor, McNary, John Day and The *Dalles* than in the 1979, 1980, and 1981.

The 1982 Detailed Fishery Operating Plan adopted by COFO on 30 March 1982 provided a project spill priority list to be used initially when the system has involuntary spill (see Table 1). Specified amounts were designated to optimize spill for fish passage at Lower Monumental, John Day, Ice Harbor and starting with Wells for the mid-Columbia PUD projects. Upon reaching these amounts, the additional spill was distributed among the projects and patterned to best control dissolvsd gas levels. Little Goose, Lower Granite, and McNary were at the bottom of the initial spill priority list to maximize their collection facility operation for fish transport to the lower river. However, on 15 April the agencies and tribes requested collection not be maximized and that these three collection projects be moved to the 5, 6 and 7 positions on the spill priority list to aid Chinook passage. The revised COFO spill priority list was adjusted quite frequently throughout the remainder of the season to control project dissolved gas levels or provide spill where fish were concentrated.



TDA
STN 3700
THE DALLES DAM (RM. 191.5)
MILLER ISLAND
DESCHUTES RIVER (RM. 204.1)
COLUMBIA RIVER
JOHN DAY DAM (RM. 215.6)
JDA STN
3757
IHR STN 916
SNAKE RIVER
ICE HARBOR DAM (RM. 9.7)
PASCO
McNARY DAM (RM. 292.0)
MCN STN 816
COLUMBIA RIVER
UMATILLA RIVER (RM. 289.0)
1982
DISSOLVED GAS
SAMPLE STATIONS
LOCATION MAP
10 SEPT 1982 NPD EN-WM KRA
NOT TO SCALE

FIGURE 1

TABLE 1

INITIAL 1982 COFO PROJECT SPILL PRIORITY LIST

30 MARCH 1982

(1) Lower Monumental----------------------up to 30,000 cfs

(2) John Day------------------------------up to 80,000 cfs

(3) Lower Monumental----------------------up to 50,000 cfs

(4) Ice Harbor----------------------------up to 50,000 cfs

(5) Wells---------------------------------up to 30,000 cfs

(6) Rocky Reach---------------------------up to 50,000 cfs

(7) Rock Island---------------------------up to 50,000 cfs

(8) Wanapum-------------------------------up to 20,000 cfs

(9) Priest Rapids-------------------------up to 40,000 cfs

(10) Chief Joseph-------------------------up to 50,000 cfs

(11) Priest Rapids------------------------up to 70,000 cfs

(12) Washington Water Power---------------up to 500 MW equivalent

(13) Grand Coulee-------------------------up to 100,000 cfs

(14) The Dalles---------------------------No Limit

(15) Lower Monumental---------------------No Limit

(16) Ice Harbor---------------------------No Limit

(17) Little Goose-------------------------No Limit

(18) Lower Granite------------------------No Limit

(19) McNary-------------------------------No Limit

Throughout the monitoring period of 14 April to 3 August 1982, the extremes of dissolved gas percentages varied at each of the four project forebay stations as follows:

Ice Harbor	: Highest	= 127.9% (5 Jul)
	Lowest	= 112.0% (14 Jul)
McNary	: Highest	= 128.6% (19 Jun)
	Lowest	= 107.5% (22 Jul)
John Day	: Highest	= 127.2% (25 Jun)
	Lowest	= 102.6% (3 Aug)
The Dallea	: Highest	= 131.1% (31 May)
	Lowest	=101.4% (2 Aug)

NOTE: See Figures 2-2a, 3-3a, 4-4a and 5-5a for a daily display of the dissolved gas percentages, water temperature and total flow parameters at each project.

The Ice Harbor Dam percentages indicate the range of dissolved gas concentrations that moved downstream from the Lower Snake River Into the McNary reservoir and from there passing through the other three projects. Changes in the gas percentage values at each of the four projects were usually related to the total amounts of water released through the powerhouse and spilled from the upstream dams. During the monitoring program, each project's gas percentage reached about the same level. This resulted from the control of the project spill for a balanced distribution of gas levels within an already saturated system. The differences in the lowest gas percentages were caused by the decreasing amounts and termination of spill on different days plus the end of monitoring at each project.

The following is a listing of the Total Dissolved Gas (TDG) saturation standards used by the northwestern States and Federal government:

Washington: **maximimum** of 110% TDG

Oregon : **maximimum of** 105% TDG

Idaho : **maximimum** of 110% TDG

Montana : **maximimum** of 110% TDG

Federal : **maximimum** of 110% TDG

During the monitoring program, even with the high river runoff experienced this year in the basin plus changes in the system regulation plan to control gas levels, each of the four projects generally exceeded the listed State and Federal **TDG** criteria. However, there were **no reports** of gas bubble disease **problems** in the migrating fish from any **of** the fishery agencies.

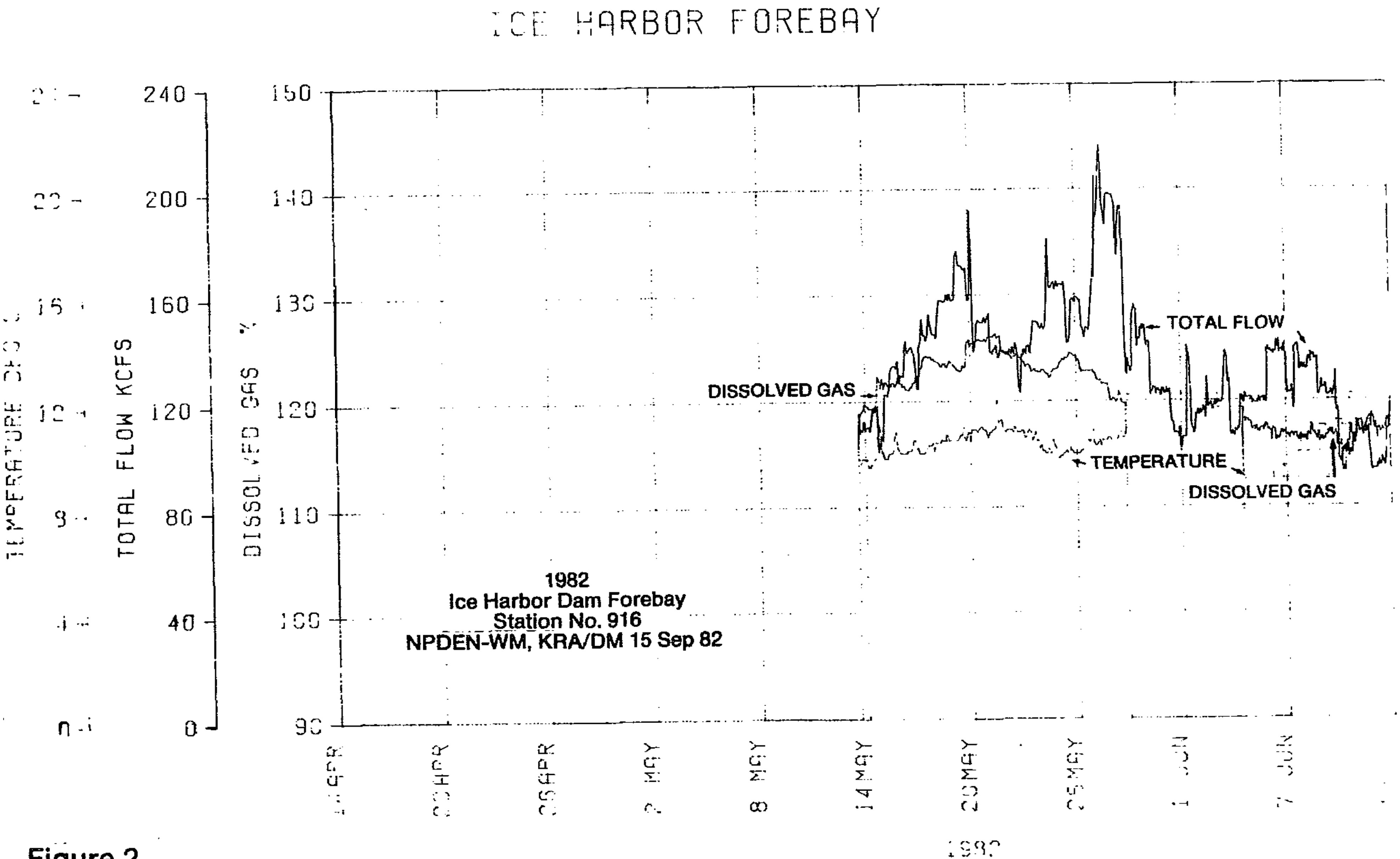

ICE HARBOR FOREBAY
TEMPERATURE
TOTAL FLOW KCFS
DISSOLVED GAS %
TOTAL FLOW
DISSOLVED GAS
TEMPERATURE
DISSOLVED GAS
1982
Ice Harbor Dam Forebay
Station No. 916
NPDEN-WM, KRA/DM 15 Sep 82
14 MAY
20 MAY
1 JUN
7 JUN
8 MAY

Figure 2

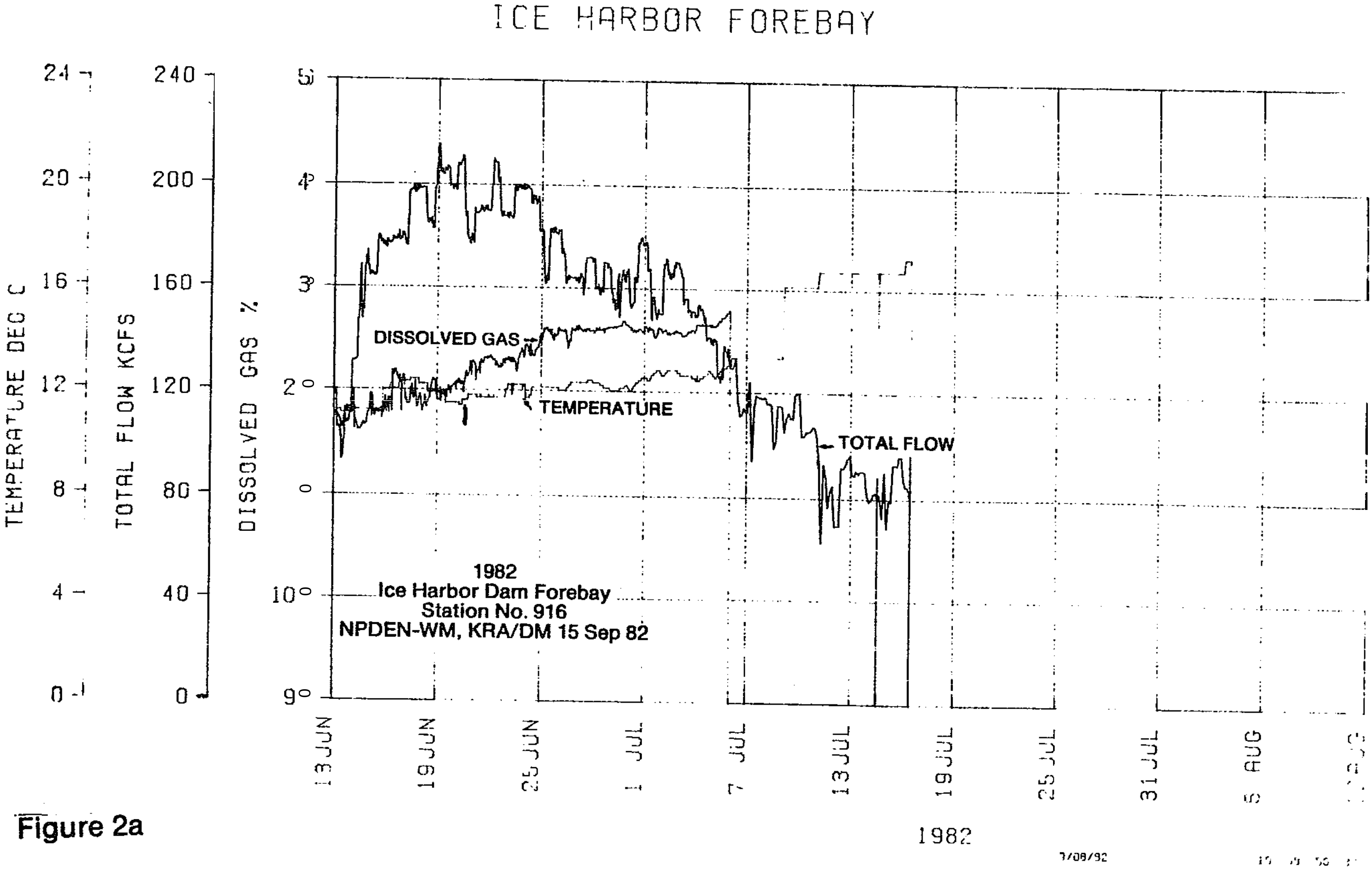

ICE HARBOR FOREBAY
TEMPERATURE DEG C
TOTAL FLOW KCFS
DISSOLVED GAS %
24
20
16
12
8
4
0
240
200
160
120
80
40
0
DISSOLVED GAS
TEMPERATURE
TOTAL FLOW
1982
Ice Harbor Dam Forebay
Station No. 916
NPDEN-WM, KRA/DM 15 Sep 82
13 JUN
19 JUN
25 JUN
1 JUL
7 JUL
13 JUL
19 JUL
25 JUL
31 JUL
6 AUG
1982

Figure 2a

MCNARY FOREBAY

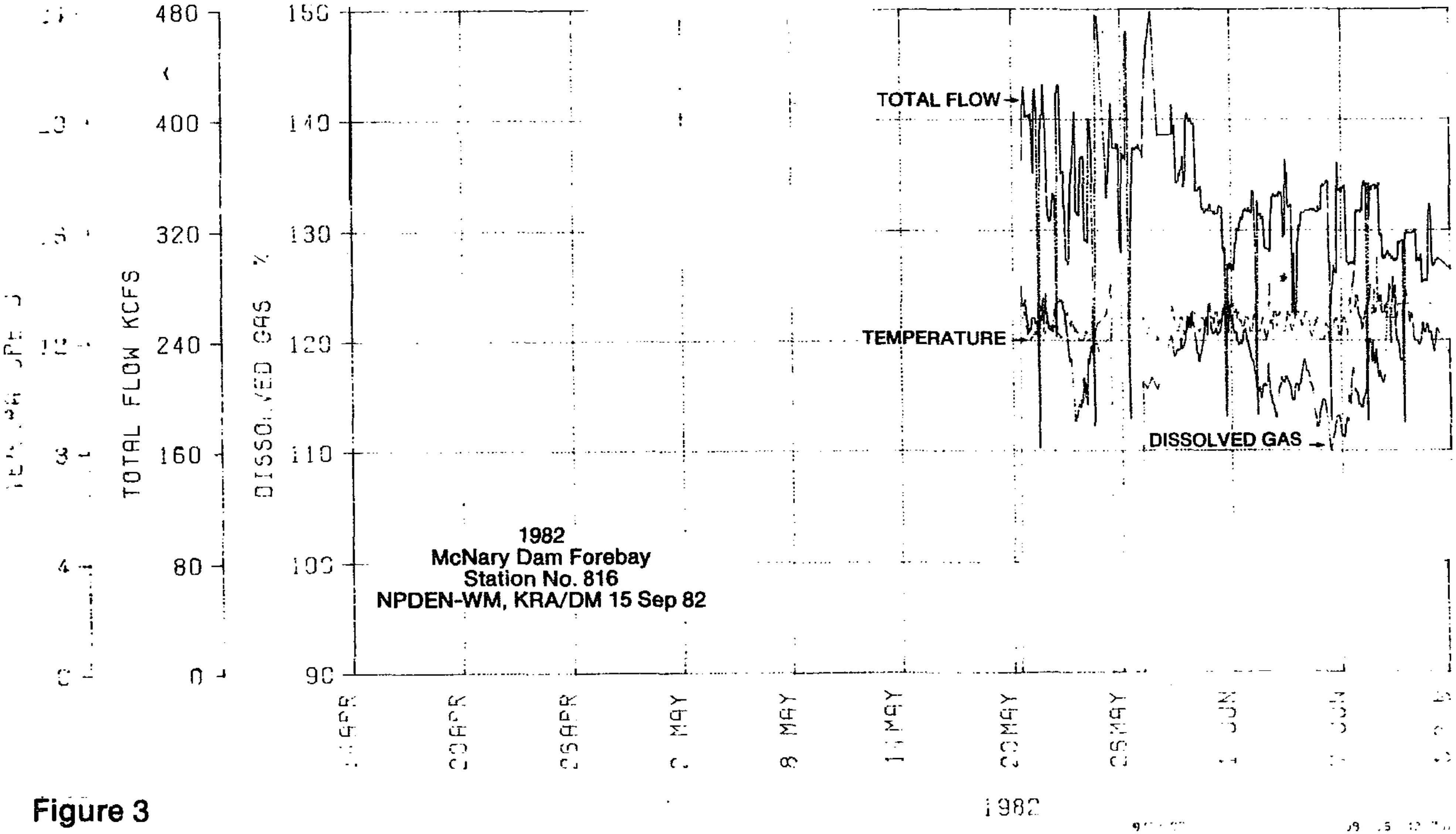
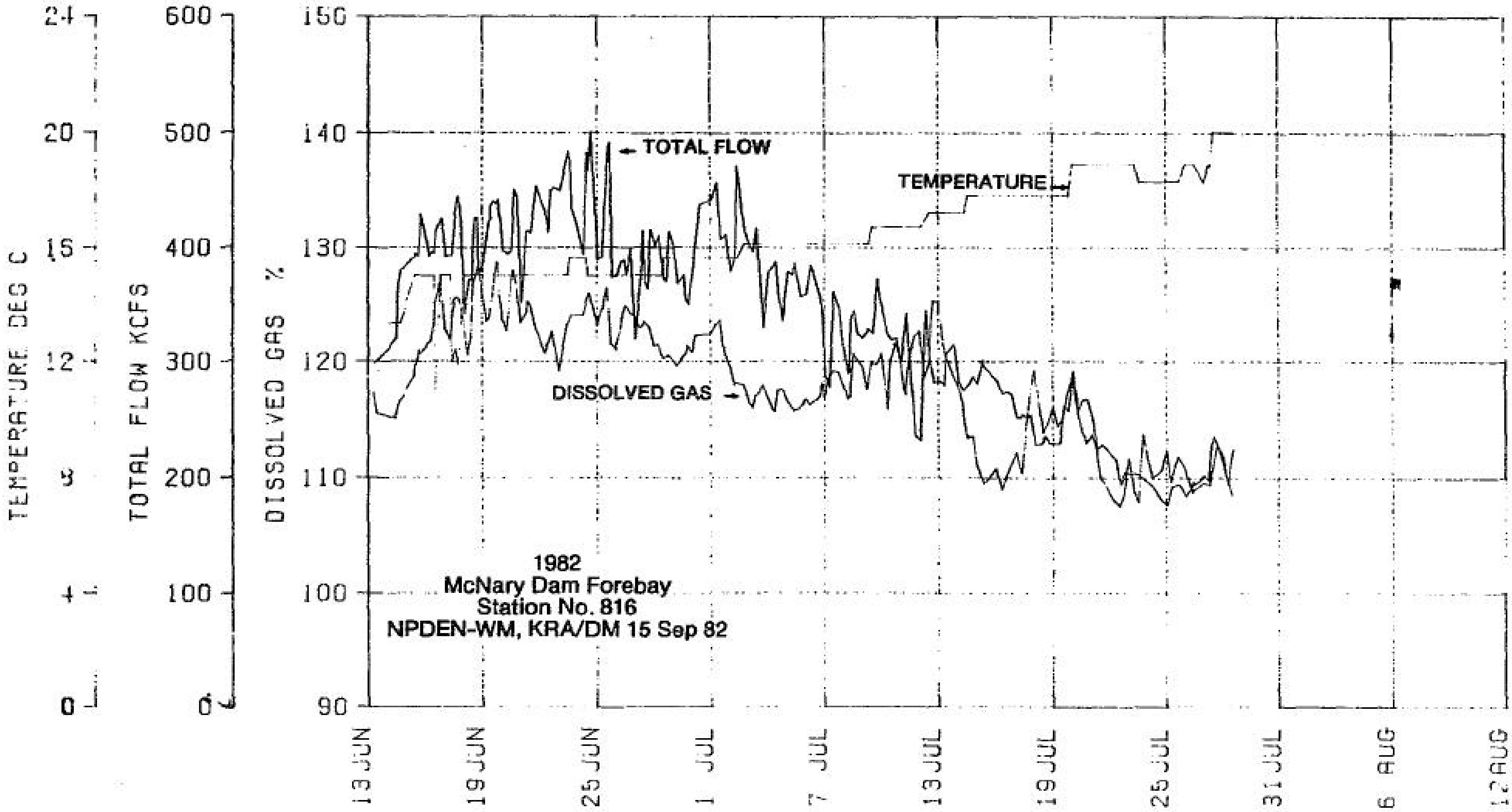
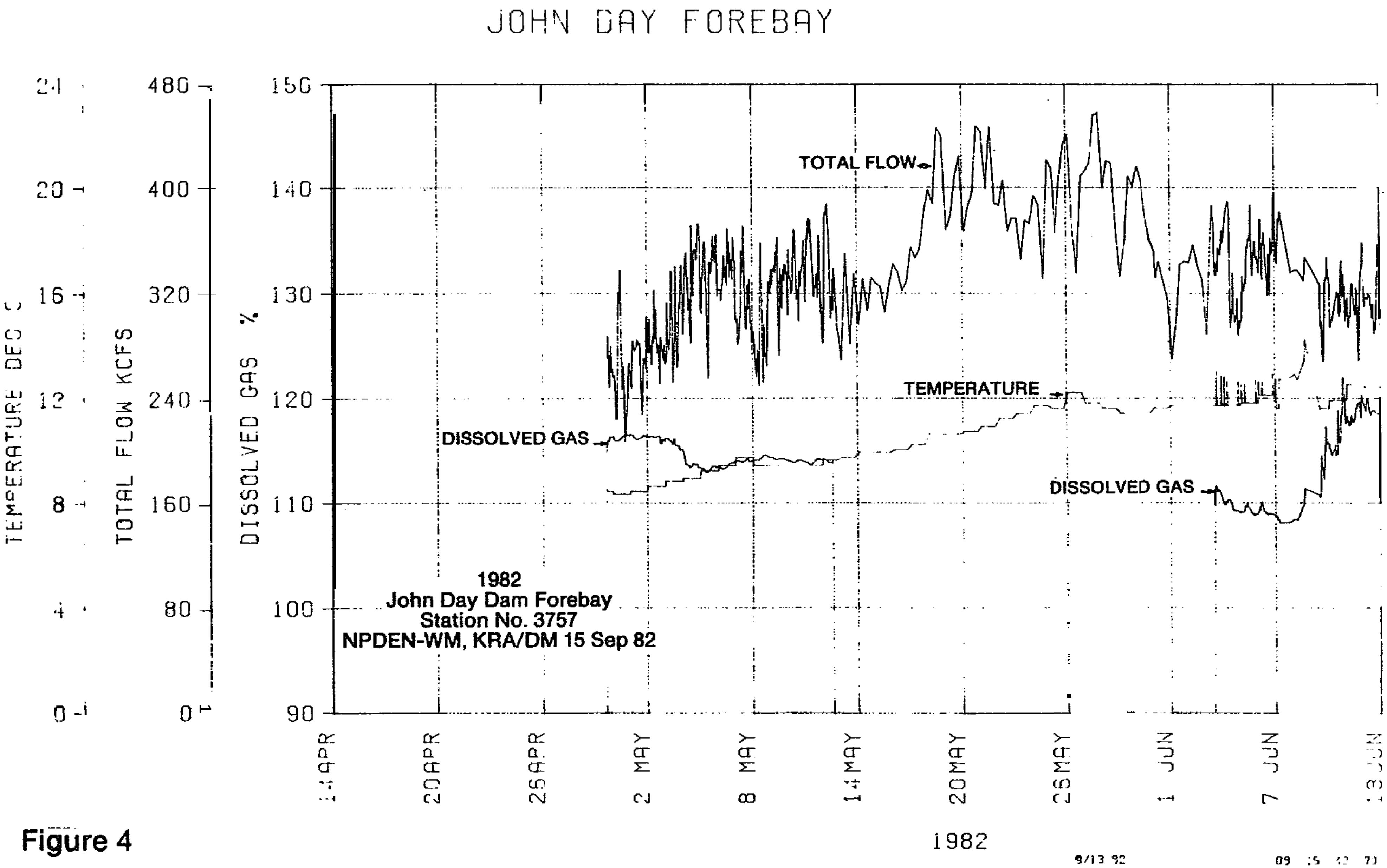


Figure 3



TOTAL FLOW
TEMPERATURE
DISSOLVED GAS
1982
McNary Dam Forebay
Station No. 816
NPDEN-WM, KRA/DM 15 Sep 82
TEMPERATURE DEG C
TOTAL FLOW KCFS
DISSOLVED GAS %
0 4 8 12 16 20 24
0 100 200 300 400 500 600
90 100 110 120 130 140 150
13 JUN
19 JUN
25 JUN
1 JUL
7 JUL
13 JUL
19 JUL
25 JUL
31 JUL
6 AUG
12 AUG



JOHN DAY FOREBAY
TEMPERATURE DEG C
TOTAL FLOW KCFS
DISSOLVED GAS %
TOTAL FLOW
TEMPERATURE
DISSOLVED GAS
DISSOLVED GAS
1982
John Day Dam Forebay
Station No. 3757
NPDEN-WM, KRA/DM 15 Sep 82
14APR
20APR
26APR
2 MAY
8 MAY
14MAY
20MAY
26MAY
1 JUN
7 JUN
13 JUN
1982

Figure 4

JOHN DAY FOREBAY

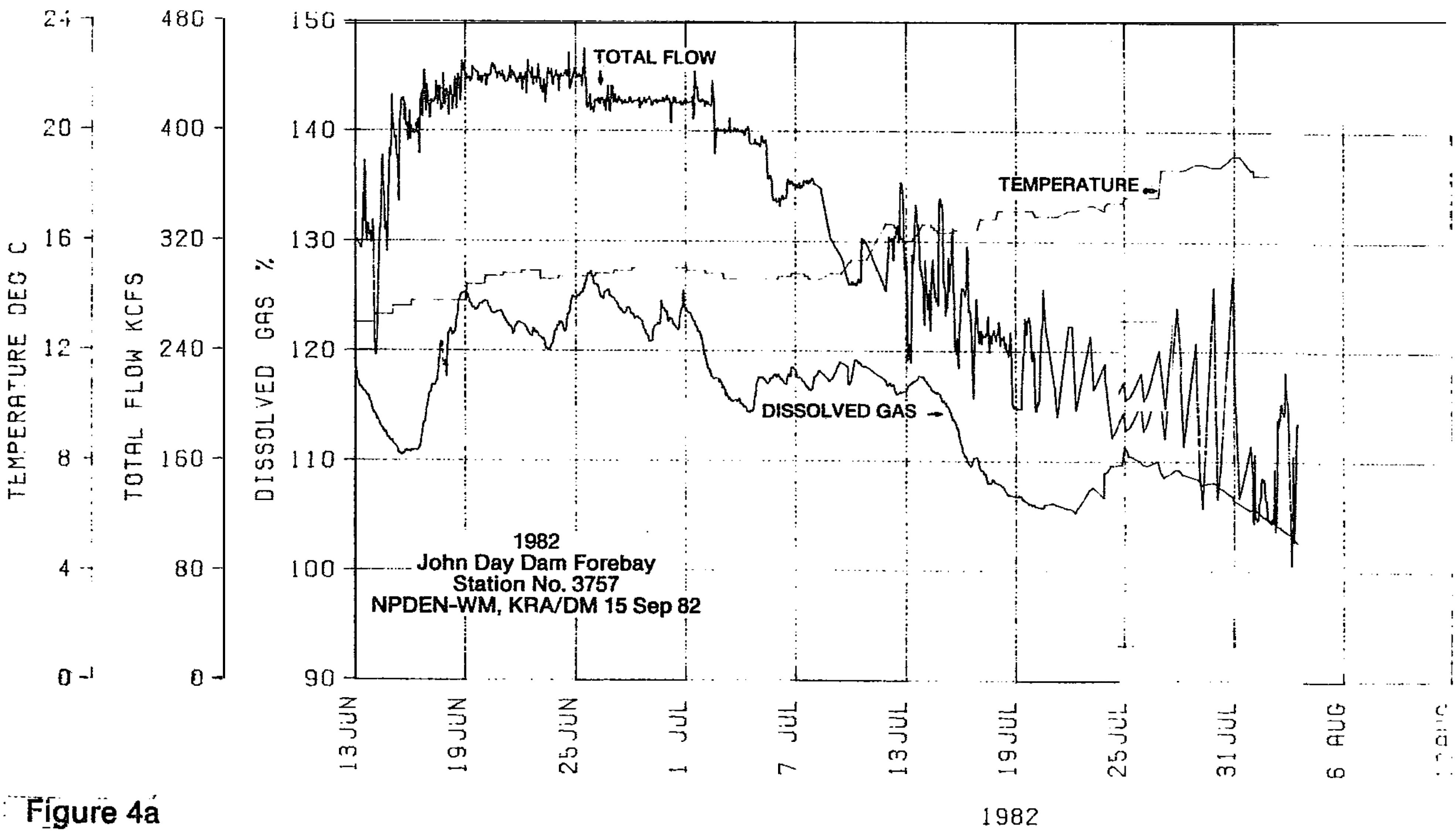


Figure 4a

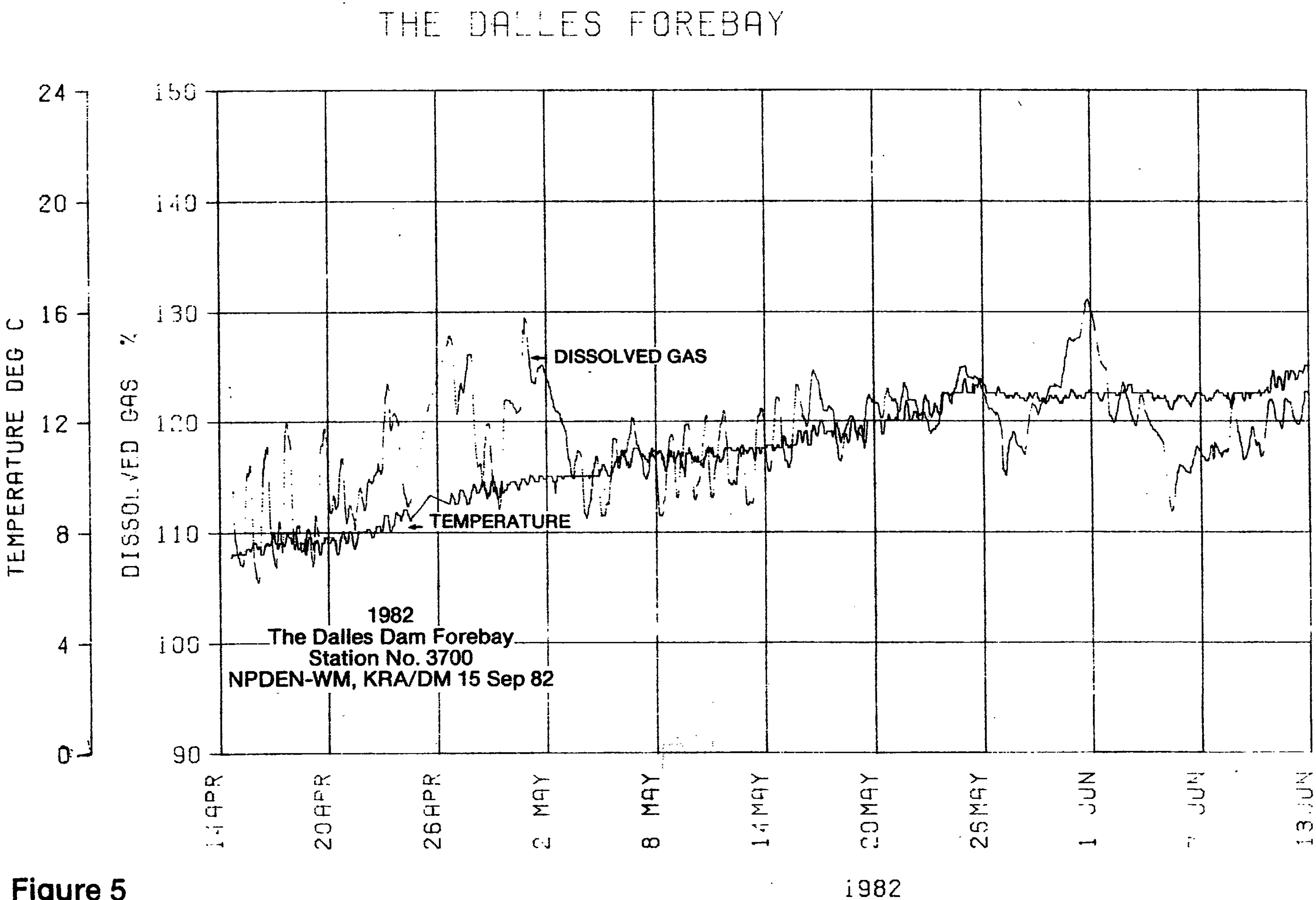

THE DALLES FOREBAY
TEMPERATURE DEG C
DISSOLVED GAS %
24
20
16
12
8
4
0
150
140
130
120
110
100
90
DISSOLVED GAS
TEMPERATURE
1982
The Dalles Dam Forebay
Station No. 3700
NPDEN-WM, KRA/DM 15 Sep 82
20APR
26APR
2 MAY
8 MAY
14MAY
20MAY
26MAY
1 JUN
7 JUN
13JUN
1982

Figure 5

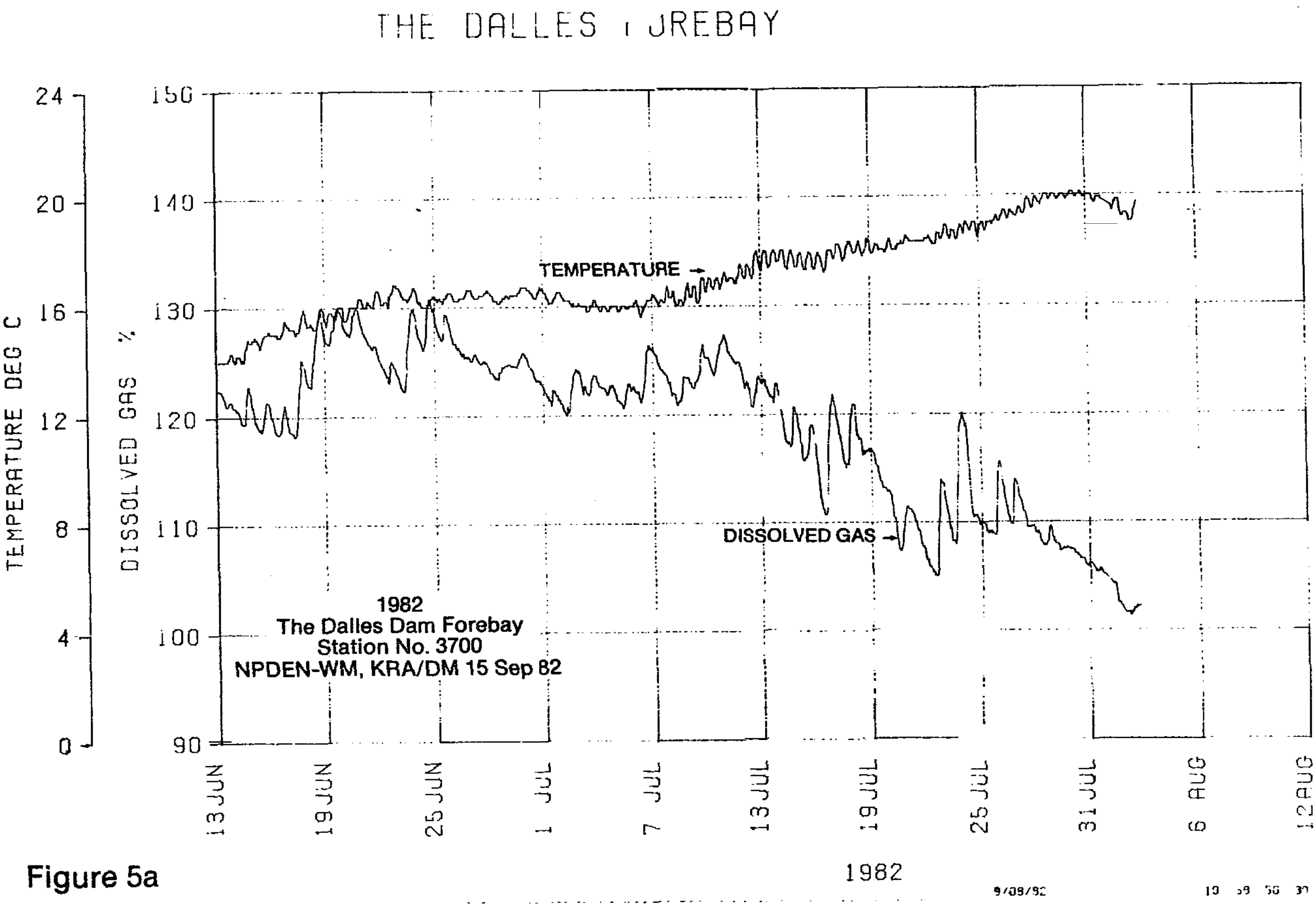

THE DALLES ı JREBAY
TEMPERATURE DEG C
DISSOLVED GAS %
TEMPERATURE
DISSOLVED GAS
1982
The Dalles Dam Forebay
Station No. 3700
NPDEN-WM, KRA/DM 15 Sep 82
13 JUN
19 JUN
25 JUN
1 JUL
7 JUL
13 JUL
19 JUL
25 JUL
31 JUL
6 AUG
12 AUG
1982

Figure 5a

CONCLUSIONS

The 1982 dissolved gas monitoring program provided the Water Management Branch with additional data at four project forebay stations. This year's program was conducted under different operational constraints; namely, that the daily parametric information was used by the RCC in consultation with the Fish Smolt Coordinator to schedule project operation and spill to reduce gas percentages for the protection of both adult and juvenile fish. Whereas, in previous lower flow years the emphasis was primarily on providing spill for juvenile downstream passage.

With our present instruments (three tensionometers vith recorders and one unit vithout a recorder), the Water Quality Section has sufficient equipment to handle future monitoring of up to three project stations. Any more gas sampling sites would mean obtaining additional equipment and personnel to meet the increased workload.

The data collected during the previous four years should provide additional information to the RCC and the fishery agencies about potential dissolved gas problems at different dams. The 1982 data obtained at McNary and Ice Harbor furnishes us with a better indication of the gas percentages moving downstream from the mid-Columbia and Lower Snake projects - especially during periods of basin high flows that caused early involuntary spill conditions

Dissolved gas monitoring must continue at The Dalles Dam forebay station since its gas percentages are affected by the spill operations conducted at John Day Dam during the fish migration period. The techniques used by the RCC in previous years to control the John Day spill for dissolved gas should be followed except when meeting the COFO juvenile fish passage criteria (see Item 3 in the Recommendations for these particular techniques).

This year, the Smolt Coordinator also received useful mid-Columbia River dissolved gas percentages from the PUDs (Rocky Reach and Priest Rapid Dams) and Grand Coulee Dam. This was the first data received during a downstream fish migration period since 1978.

Our 1982 gas monitoring program covered a period of involuntary spill that had not been previously experienced. This, in turn also created higher project gas percentages throughout the basin that resulted in the dams generally exceeding the federal and state dissolved gas criteria. But, vith changes in the system regulation plans to control the gas levels, it was possible to successfully move the migrating fish without any reported gas bubble disease problems from the fishery agencies.

This year's program was successfully executed because of the fine cooperation between the Corps, especially project operating personnel, the Fisheries, and other interested agencies. A continued spirit of collaboration will insure that disnolved gas problems will be minimized in the future.

RECOMMENDATIONS

It is recommended that the following actions be taken for 1983-84:

1. Determine the number of instruments required for gas monitoring and their assigned location by 20 March through coordination with the fisheries and the RCC.

2. Continue monitoring at The Dalles Dam East Power Side forebay station sinoe the gas percentage amounts are directly related to the John Day Dam spills.

3. Conduct the John Day Dam spill with respect to dissolved gas as follows:

   (a) keep the project spill in each bay under 160 cfs per foot of width (9,000 cfs per spillway) as river flow conditions permit;

   (b) spread the total amount of spill water over all twenty bays to reduce the downstream dissolved gas; and

   (c) avoid concentrating the spill in a few bays which increases the gas percentages below the dam.

4. Locate a tensionometer with recorder at both the McNary Dam's Washington and Oregon forebay sites to obtain more representative data about the alignment of the Columbia and Snake River water passing through the projeot.

5. Incorporate the interested Washington State Public Utility Districts into a cooperative dissolved gas monitoring program during the fish migration season. This action would provide improved project coverage of specific mid-Columbia River water quality parameters; i.e., total dissolved gas, dissolved oxygen, water temperature, project barometric pressure, etc. Each PUD would transmit their parametric data via the CBTT teletype circuits to the Division's CROHMS data files. This information would be available for use by any interested agencies throughout the monitoring period.

6. Develop a comprehensive plan for any long-term (2-4 years) gas monitoring and related equipment acquisitions, program implementation and associated funding. One aspect of this particular plan would be that NPD contract and obtain the services of a private company to conduct all or part of the yearly gas monitoring program.