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DWORSHAK RESERVOIR INVESTIGATIONS: TROUT, BASS AND FORAGE SPECIES

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DWORSHAK RESERVOIR INVESTIGATIONS:
TROUT, BASS AND FORAGE SPECIES

Annual Report FY 1987

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This study was funded by the Bonneville Power Administration. The U.S. Army Corps of Engineers provided data on reservoir operation and recreational use. The U.S. Fish and Wildlife Service, Fisheries Assistance Office, Ahsahka, Idaho, furnished data on Dworshak Reservoir fish stocking. The Idaho Department of Fish and Game, Dworshak Project Office, assisted in the collection of creel data. Services were provided by Russell C. Biggam, University of Idaho entomologist, for diet analysis. Kendall C. Jackson, fisheries technician, collected creel data and assisted in purchasing and record-keeping.

ABSTRACT

Dworshak Dam and Reservoir is a Corps of Engineers facility located on the North Fork Clearwater River 3.2 km upstream from the Mainstem Clearwater confluence. Since initial filling in 1971, conversion of 87 km of river habitat to a 6,644 hectare impoundment has had a profound influence on resident fisheries. The Nez Perce Tribe and the Idaho Department of Fish and Game (IDFG) entered into separate intergovernmental agreements with the Bonneville Power Administration in a cooperative effort to study these impacts. The kokanee Oncorhynchus nerka assessment is included in the IDFG agreement, and is not addressed in this report.

This project pertains primarily to rainbow trout Salmo gairdneri, smallmouth bass (Micropterus dolomieui), and forage species. For the period November 1987 through February 1988, an estimated 4,339 angler-hours were expended to catch 430 rainbow trout. An estimated 20 bull trout Salvelinus confluentus, 4 smallmouth bass, and 4 suckers Catostomus spp. were also caught.

Catch rates were generally poor through the period, at .091 fish per hour for all species combined (excluding kokanee). Shasta strain hatchery rainbow trout were dominant in the creel, comprising 53.9 percent of the catch, although this strain was last planted in the reservoir in June 1986. Bank anglers caught a higher percentage (93.5 percent) of the total catch of Shasta strain rainbows than Kamloops strain rainbows (33.3 percent).

Analysis of trout stomach contents indicated a broad assortment of aquatic and terrestrial forms, suggesting opportunistic feeding promoted by a limited reservoir food resource. Chironomids, Trichopterans, and terrestrial spiders were among the more frequently occurring items in stomach samples analyzed. A very limited sample size obtained to date may suggest higher utilization of Cladocera by the Kamloops strain rainbow, as compared to the Shasta strain, intimating a more pelagic habitat utilization. Additional Kamloops stomach samples are needed, however, for a satisfactory evaluation.

Due to extremely low catch rates through the period, no smallmouth bass stomach samples were obtained for analysis.

INTRODUCTION

Following construction of Dworshak Dam by the U.S. Army Corps of Engineers (CE), initial filling of Dworshak Reservoir began on 27 September 1971. The subsequent conversion of 86.2 km of the North Fork Clearwater River to a 6,644 hectare artificial lake has had a profound influence on resident fish and fisheries. Also, reservoir operation results in annual pool level fluctuations that exert a chronic influence on reservoir habitat.

Post-impoundment fishery information (Pettit 1976); Horton 1980, 1981) and limnological data (Falter et al. 1979) indicates considerable change in reservoir fisheries and limnology since initial filling. Occurrence of smallmouth bass *Micropterus dolomieui* in the creel has diminished:, abundance of redside shiners *Richardsonius balteatus*, an important forage species, has decreased; kokanee *Oncorhynchus nerka* abundance has fluctuated; and primary productivity has decreased with a shift towards oligotrophy.

Recognizing the pervasive influence of Dworshak Dam on resident fisheries, the Northwest Power Planning Council in its Columbia River Basin Fish and Wildlife Program [903(e) (4)] provided that:

> BPA shall fund a study to assess the impacts of the original construction and current operation of Dworshak Dam on the resident fishery. This study will include the following research concerns of the Nez Perce Tribe: 1) population dynamics of kokanee; 2) reservoir productivity; 3) food habits of rainbow trout; 4) population dynamics and habitat preferences of smallmouth bass; and 5) the status of forage species. Recommendations detailing specific protection, mitigation and enhancement opportunities, consistent with the requirements of 804(e) (16), may be submitted to the Council [804(e) (12)].

The Nez Perce Tribe, along with the Idaho Department of Fish and Game (IDFG), executed intergovernmental agreements with Bonneville Power Administration in a cooperative effort to study the five concerns stated above. This report is the first annual report of a four-year project that addresses food habits of rainbow trout *Salmo gairdneri*, population dynamics and habitat preferences of smallmouth bass, and status of forage species. In order to meet report scheduling, findings reported herein are from initiation of data collection in November 1987 through February 1988. IDFG will address population dynamics of kokanee and reservoir productivity.

DESCRIPTION OF THE PROJECT AREA

Dworshak Dam is located on the North Fork Clearwater River 3.2 km upstream from its confluence with the Mainstem Clearwater River (Figure 1). Maximum pool was first attained on 3 July 1973 (Horton 1981). At normal full pool elevation (1,600 feet mean sea level), Dworshak Reservoir extends 86.2 km along the North Fork Clearwater River Canyon, encompassing 6,644 hectares surface area with 282 km of shoreline. Maximum width at full pool is 2743 m, and average width is 547 m.

RESERVOIR OPERATION

The primary purposes of Dworshak Dam are power and flood control. Dam operation is integrated with the total system of Columbia River reservoirs to meet power system load requirements and to provide flood control regulation on the lower Columbia, lower Snake, and lower Clearwater Rivers. Power production is highest during the fall, winter, and early spring.

Expected minimum discharge through the turbines from April to July is 2,000 cfs. Reservoir evacuation begins in September and generally continues through March. Refilling occurs with the influx of spring flows from April to July. The date of filling to normal full pool varies from mid-June to late July, depending on run-off conditions.

The normal operating range of Dworshak Reservoir is from 1,445 to 1,600 feet mean sea level (Figure 2). Annual pool level fluctuations in excess of 30.5 m are common.

FISH SPECIES AND ABUNDANCE

Prior to impoundment, fish species present in the study area included steelhead trout Salmo gairdneri, chinook salmon Oncorhynchus tchawytscha, cutthroat trout Salmo clarki, bull trout Salvelinus confluentus, brook trout Salvelinus fontinalis, mountain whitefish Prosopium williamsoni, brown bullhead Ictalurus nebulosus, smallmouth bass, chiselmouth Acrocheilus alutaceus, northern squawfish Ptychocheilus oregonensis, bridgelip sucker Catostomus columbianus, largescale sucker Catostomus machrocheilus, speckled dace Rhinichthys osculus, longnose dace Rhinichthys cataractae, redside shiner, and pacific lamprey Entosphenus tridentatus.

Following impoundment, a Memorandum of Understanding between the U.S. Army Corps of Engineers and the U.S. Fish and Wildlife Service formalized a 100,000 pound (45,360 kg) annual mitigation requirement for resident fish. A stocking program of various species, including cutthroat trout, bull trout, rainbow

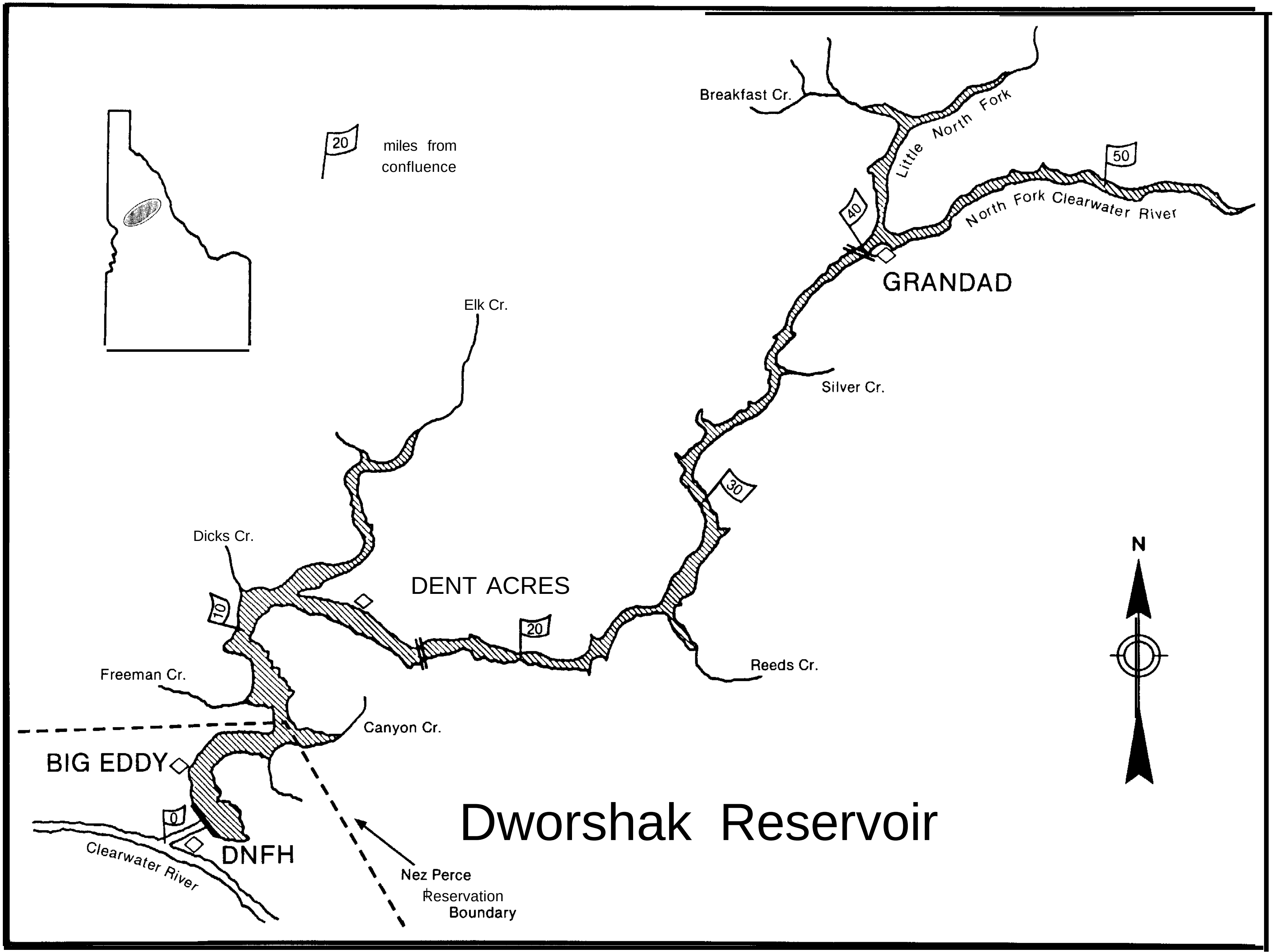

Figure 1. Dworshak Dam and Reservoir, North Fork Clearwater River, Idaho

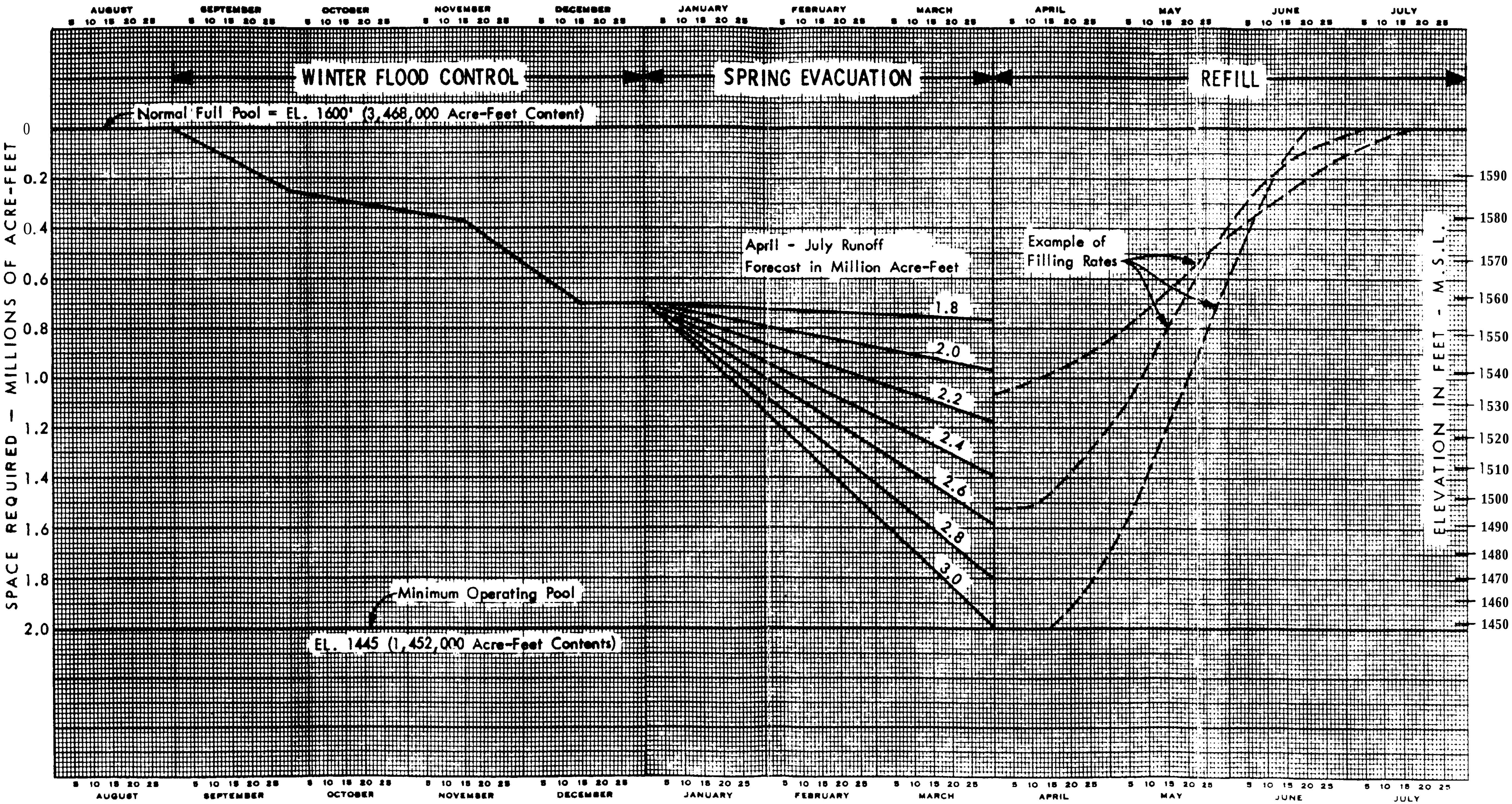

Figure 2. U. S. Army Corps of Engineers' operating curve for flood control, Dworshak Dam and Reservoir, Idaho.

trout, smallmouth bass, and kokanee, followed (Miller 1987). Smallmouth bass were stocked in 1975, 1977, and 1979. Kokanee were stocked from 1972 through 1975, and in 1977 and 1979. Rainbow trout have been stocked since 1972 (Table 1).

Horton (1981) reported that largemouth bass Micropterus salmoides entered the creel as early as 1976, apparently from contaminated smallmouth bass stocking. Horton (1980) also confirmed the presence of northern pike Esox lucius, but indicated a low probability of a viable population becoming established. Roseburg (1988) reported catching crappie Pomoxis spp. in the Cranberry Creek inlet. Horton (1981) documented collection of a lamprey ammocete while electrofishing near river mile 50. Lamprey parasitism on sport fish has been-reported by Ball and Pettit (1974) and Pettit (1976). No lamprey scars have been reported after Wallace and Ball (1978). Twenty fish species inhabiting Dworshak Reservoir have been documented (Table 2).

LIMNOLOGY AND HABITAT

Falter et. al (1979) characterized Dworshak Reservoir as a deep, coldwater reservoir with the lower 32.2 km being monomictic and the upper reservoir being dimictic. Falter's work showed that, after three years, the reservoir dropped from moderately productive to oligotrophic. Wave action on exposed side and bottom sediments was identified as a continuous source of turbidity. Phosphorus was noted as the nutrient generally limiting algal growth. Considering the pronounced oligotrophy of Dworshak Reservoir, Falter mentioned sterilized sewage wastes from recreation sites as a possibility to stimulate productivity in certain embayments.

Tributary feeder streams influence reservoir habitat in the immediate vicinity of the inflow as well as in the major arms. Pettit (1976) stated that, because of the inflow of organisms in the vicinity of stream mouths, fish have a tendency to concentrate in these areas. Falter (1979) found water quality in Elk Creek Arm to be more similar to Elk Creek than the North Fork Clearwater River. During the 1977 low run-off year, Falter (1982) recorded a sharp early summer temperature increase in Elk Creek Arm (EC4 site), probably as a result of warm Elk Creek inflows.

Commercial floating log rafts at specified log dump locations, such as Merry's Bay, Canyon Creek, and Little North Fork River, locally influence habitat parameters including water

Table 1. Stocking of resident fish into Dworshak Reservoir by year, 1972 to 1987 (Miller 1987).

Year	Specie6	Number	Size Range	Weight (Pounds)
1972	Kokanee Salmon	1,012,745	2.5-3.5"	10,176
	Rainbow trout	1,043,506	Fry-12"	99,917
1973	Kokanee Salmon	591,192	Fry	393
	Rainbow trout	2,554,170	Fry-12"	134,808
1974	Cutthroat trout	45,463	5 "	2,285
	Kokanee salmon	217,288	2.5"	1,999
	Rainbow trout	1,070,260	2.5-12"	19,075
1975	Cutthroat trout	111,010	2-6.5"	797
	Bull trout	122,789	Fry	107
	Kokanee salmon	2,898,417	Fry-2"	2,368
	Rainbow trout	917,856	Fry-12"	114,301
	Smallmouth bass	100,253	Fry-9"	Unknown
1976	Rainbow trout	763,286	2-10"	64,113
1977	Kokanee salmon	2,450,000	Fry	1,113
	Rainbow trout	1,162,670	2-11"	34,217
	Smallmouth bass	50,000	Fry	15
1978	Rainbow trout	25,936	10-12"	13,412
1979	Kokanee salmon	11,177,464	Fry	985
	Rainbow trout	1,313,524	2-10"	92,541
	Smallmouth bass	100,000	Fry	20
1980	Rainbow trout	1,616,245	2-10"	36,052
1981	Rainbow trout	861,429	2-10"	87,049
1982	Rainbow trout	153,956	3-11"	34,940
1983	Rainbow trout	574,255	3-9"	58,503
1984	Rainbow trout	67,561	9-11"	27,285
1985	Rainbow trout	120,000	9"	40,000
1986	Rainbow trout	156,773	6"	14,388
1987	Rainbow trout	174,256	3.5-4.5"	5,095

Table 2. Fish species inhabiting Dworshak Reservoir, Idaho (modified from Horton 1981).

Common Name	Scientific Name
Chiselmouth[1]	Acrocheilus alutaceus
Bridgelip sucker	Catostomus columbianus
Largescale sucker	Catostomus macrocheilus
Sculpin	Cottus spp.
Northern pike	Esox lucius
Pacific lamprey	Entosphenus tridentatus
Brown bullhead	Ictalurus nebulosus
Smallmouth bass	Micropterus dolomieui
Largemouth bass	Micropterus salmoides
Kokanee	Oncorhynchus nerka
Crappie[2]	Pomoxis spp.
Mountain whitefish	Prosopium williamsoni
Northern squawfish	Ptychocheilus oregonensis
Longnose dace	Rhinichthys cataractae
Speckled dace	Rhinichthys osculus
Redside shiner	Richardsonius balteatus
Cutthroat trout	Salmo clarkii
Rainbow trout	Salmo gairdneri
Bull trout	Salvelinus confluentus
Brook trout	Salvelinus fontinalis

[1] Chiselmouth documented prior to impoundment, but may have been eradicated in the 1971 squoxin treatment (Ball and Cannon 1972).

[2] Reported by Roseburg (1988).

quality and cover. In situ bioassay by Falter et. al (1979) showed that log leachates generally increased algal production, though a toxic response was noted in some algal genera. Pettit (1976) noted that invertebrates found in fish stomachs were associated with floating debris.

Fluctuations in water level, coupled with the characteristic unstable steep-sided banks, essentially preclude establishment of rooted littoral vegetation. Rooted vegetation does occur on some gentler slopes, however, these areas are above the waterline during the reservoir evacuation period.

MATERIALS AND METHODS

CREEL SURVEY

The large aerial extent of Dworshak Reservoir poses some difficulties in obtaining adequate coverage for an intensive creel survey with a reasonable degree of effort. Previous surveys (Pettit 1976) addressed this problem by dividing the reservoir into three sections: Dworshak Dam to Dent Bridge (Section I); Dent Bridge to Grandad Bridge (Section II), and Grandad Bridge to the upstream limit of the reservoir (Section III). Pettit used aerial flights to determine an expansion factor to estimate fishing effort and harvest based on observations made at Big Eddy Access Site.

This study incorporates the three survey sections previously established, however, direct counts of anglers were made by boat. A stratified two-stage probability sampling regime (Malvestuto 1983) was employed, using non-uniform probabilities commensurate with use data provided by CE. Sampling probabilities assigned were 0.8 for Section I, 0.1 for Section II and 0.1 for Section III. Thus, the area receiving the most fishing effort was sampled more frequently. CE use data are also utilized to adjust sampling probabilities to reflect seasonal use patterns, such as boat anglers following the late summer migration of kokanee towards spawning areas.

Five weekdays and five weekend days per month were sampled to collect interview data for catch rates (fish per hour) and characterization of the fishing populace (Appendix A), for fishing pressure (angler-hours), and to collect pertinent biological data from the creel. One A.M. angler count and one P.M. count were made on each sample day. Bank anglers and boat anglers were tallied separately. Similar to Pettit (1976) pressure data were further divided into three broad habitat types: (1) main reservoir; (2) major arms, and; (3) creek mouths (Appendix B).

Interview data during this reporting period focused on Big Eddy and Bruces Eddy Access Sites near Dworshak Dam. These were the only operable boat launching sites during the winter drawdown period (Figure 3) and were the primary sites for winter bank angling. Angler counts by vehicle were substituted for the boat surveys during December and January due to extremely limited fishing access.

Monthly estimates of angler-hours were calculated as a product of the mean number of anglers per hour (mean instantaneous count) and the total monthly daylight hours (weekday and weekend). Catch rates were calculated for each species, and each identifiable hatchery rainbow trout strain, from monthly summaries of interview data. Monthly harvest estimates were derived from the catch rates of each species (or

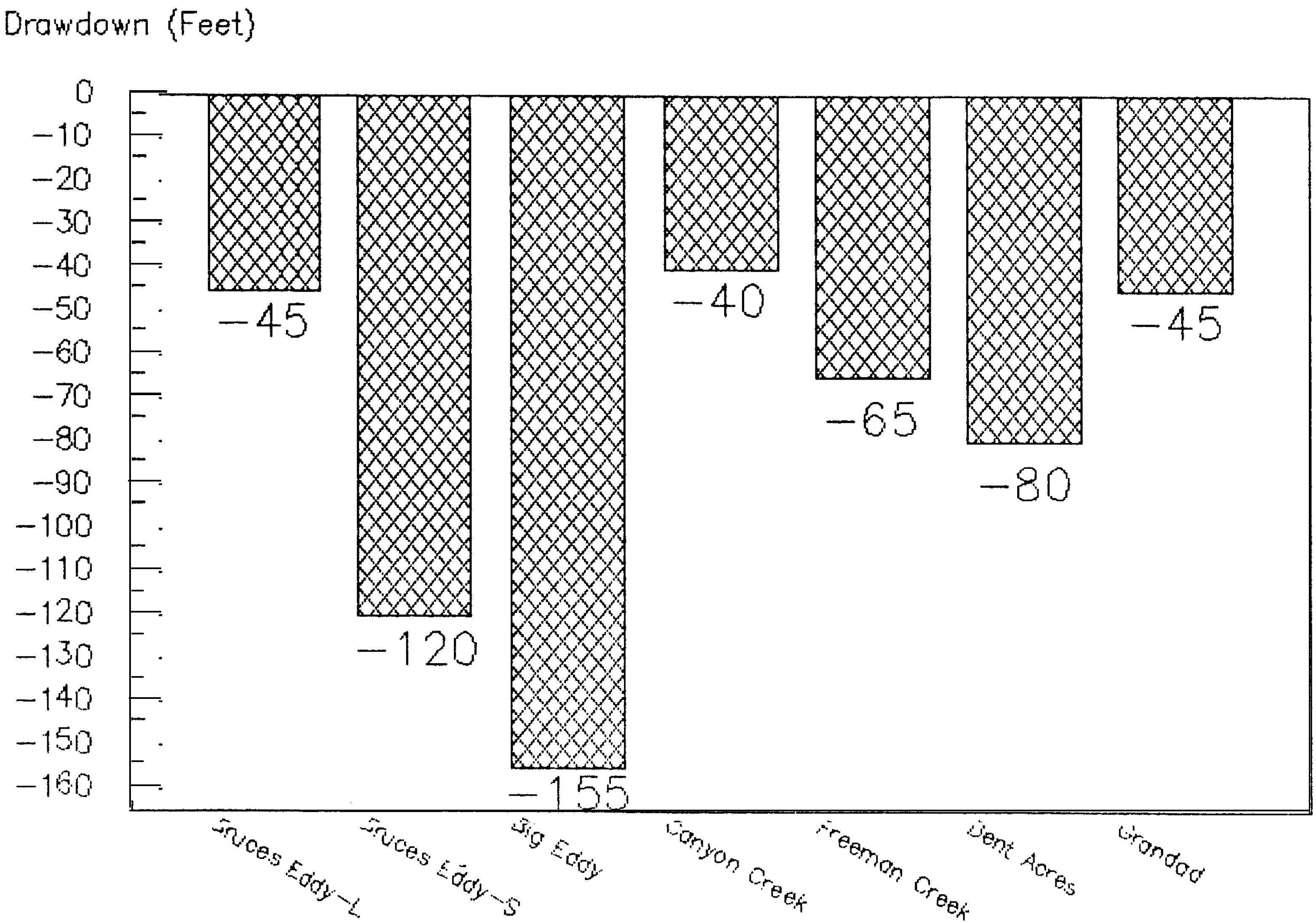

Figure 3. Drawdown at which boat launch ramps become inaccessible, Dworshak Reservoir, Idaho
Data from U.S. Army Corps of Engineers, Dworshak Project Office, Ahsahka, Idaho.

strain) and estimated effort.

Lengths, weights, scale samples, and stomach samples were taken from specimens observed in the creel.

The creel survey was conducted jointly with IDFG.

FOOD HABITS

Following collecting, fixing, and labeling of fish stomach samples from the creel, stomach contents were sorted, and insects were identified to family or genus. Non-insects were identified to order. Identified taxa in each sample were counted and percent volume of plant, animal, and mineral material was visually estimated.

RESULTS AND DISCUSSION

CREEL SURVEY

Creel survey data indicated an estimated 4,339 angler-hours were expended from November 1987 through February 1988 (Table 3). Bank angling constituted 50.8% of the total (2,204 angler-hours), while boat angling comprised 49.2% (2,135 angler-hours). All pressure observed was within Section I.

Monthly total fishing pressure for the period ranged from a low of 506 angler-hours in December to a high of 1,496 angler-hours in November. Monthly boat angling effort exhibited a wide variation from a meager 82 angler-hours in December to a high of 1,013 angler-hours in November.

A total of seven species and strains were documented in the creel, excluding kokanee to be addressed by IDFG. Shasta and Kamloops strains of hatchery rainbow trout were identifiable by length frequency distribution (Figure 4). These two groups were both marked with adipose fin clips, however, the Shastas were released in June 1986 (mean length 155mm) and the Kamloops were released in July 1987 (mean length 117mm).

Catch rates through the survey period were generally poor with and overall rate of .091 fish per hour (bank and boat combined). The highest overall monthly catch rate was recorded in November, at .166 fish per hour (Table 4).

Differential catch rates for species and strains harvested showed that the Shasta and Kamloops hatchery rainbow trout provided the highest catch per unit effort. Catch rates for Shasta strain rainbow were consistently higher for bank anglers that for boat anglers. Catch rates for Kamloops strain rainbow were higher for boat anglers than bank anglers during November and February, when boat angling effort was equal to or greater than bank angling effort.

An estimated 458 fish were caught by anglers during the survey period (Table 5). Shasta and Kamloops strain rainbow trout provided the bulk (82.1%) of the catch. Of the 247 Shasta strain rainbow taken , 93.5% were caught by bank anglers. However, 66.7% of the Kamloops strain caught were by boat anglers.

The combined catch for other species observed in the creel represented only 17.9% of the total catch.

The prevalence of Shasta strain rainbow trout in the creel, despite the fact that no Shastas were planted in Dworshak in

Table 3. Estimated monthly angler-hours for bank and boat anglers on weekdays and weekends from November 1987 through February 1988, Dworshak Reservoir Idaho.

	Nov		Dec		Jan		Feb		Tot	
	Bank	Boat	Bank	Boat	Bank	Boat	Bank	Boat	Bank	Boat
Weekdays	256	811	238	77	372	237	526	112	1392	1237
Weekends	227	202	186	5	266	151	133	540	812	898
Total	483	1013	424	82	638	388	659	652	2204	2135

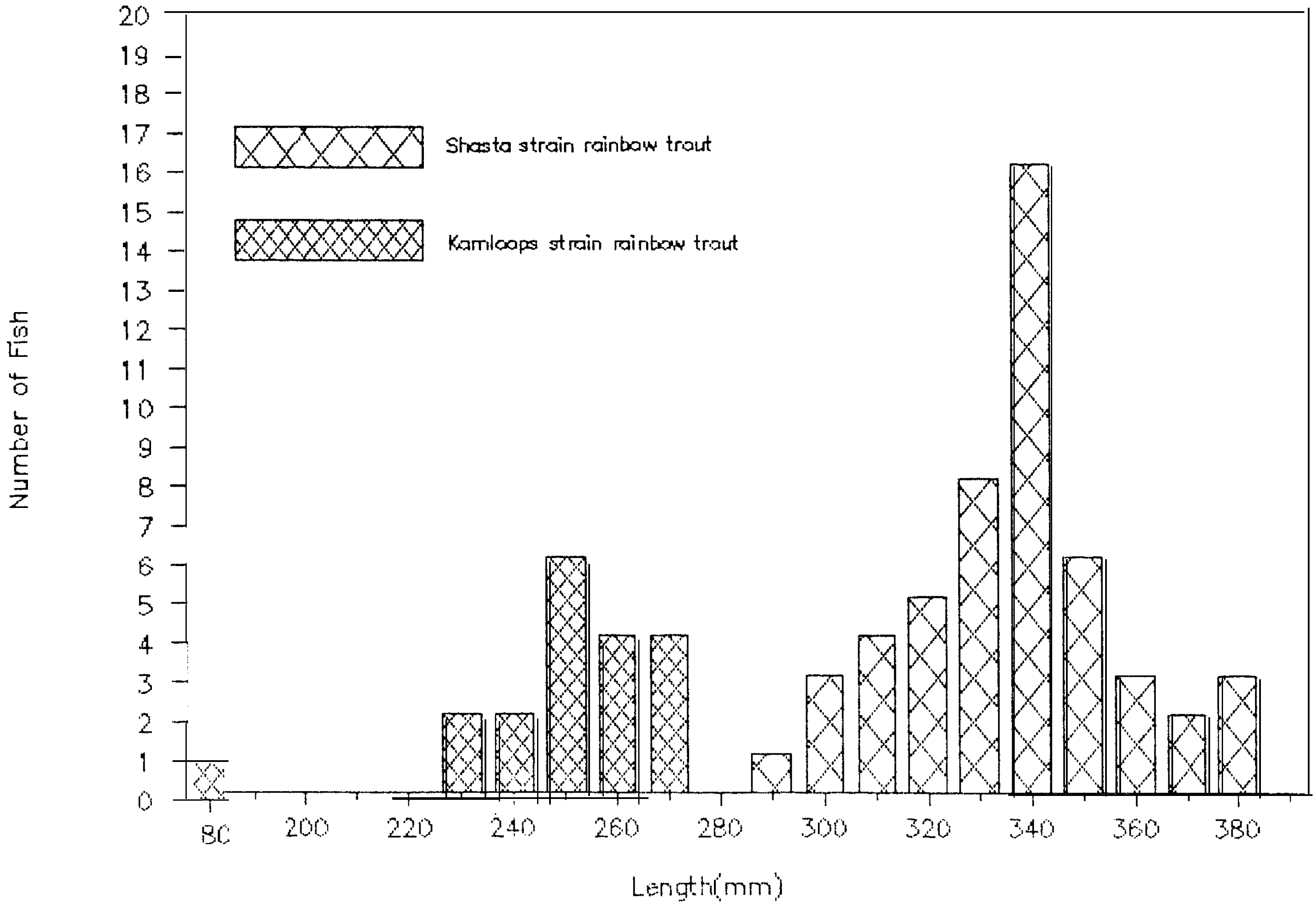

Figure 4. Length–frequency of adipose fin clipped rainbow trout sampled from the creel from November 1987 through February 988, Dworshak Reservoir, Idaho.

Table 4. Estimated monthly catch rates (fish per hour) for bank and boat anglers per species and strain from November 1977 through February 1988, Dworshak Reservoir, Idaho.

Species/ Strain	November		December		January		February		Nov-Feb	
	Bank	Boat	Bank	Boat	Bank	Boat	Bank	Boat	Bank	Boat
Shasta Rainbow	0.172	0.000	0.092	0.000	0.050	0.014	0.118	0.017	0.100	0.012
Kamloops Rainbow	0.046	0.077	0.082	0.000	0.008	0.000	0.007	0.013	0.018	0.023
Other Hatchery Rainbow	0.023	0.026	0.000	0.000	0.000	0.000	0.000	0.000	0.004	0.008
Wild Rainbow	0.000	0.000	0.028	0.000	0.000	0.000	0.000	0.008	0.006	0.004
Bull Trout	0.000	0.008	0.018	0.000	0.008	0.000	0.000	0.000	0.006	0.002
Smallmouth Bass	0.000	0.000	0.009	0.000	0.000	0.000	0.000	0.000	0.002	0.000
Sucker	0.000	0.000	0.000	0.000	0.008	0.000	0.000	0.000	0.002	0.000
All Species/Strains	0.241	0.111	0.188	0.000	0.089	0.014	0.125	0.038	0.137	0.047
Bank and Boat Combined	0.166		0.153		0.043		0.070		0.091	

Table 5. Estimated monthly harvest per species and strain from November 1987 through February 1988, Dworshak Reservoir, Idaho.

Species/ Strain	November		December		January		February		Nov-Feb	
	Bank	Boat	Bank	Boat	Bank	Boat	Bank	Boat	Bank	Boat
Shasta Rainbow	82	0	39	0	32	5	78	11	231	16
Kamloops Rainbow	22	78	12	0	4	0	5	8	43	86
Other Hatchery Rainbow	11	26	0	0	0	0	0	0	11	28
Wild Rainbow	0	0	12	0	0	0	0	5	12	5
Bull Trout	0	8	8	0	4	0	0	0	12	8
Smallmouth Bass	0	0	4	0	0	0	0	0	4	0
Sucker	0	0	0	0	4	0	0	0	4	0
All Species/Strains	115	112	75	0	44	5	83	24	317	141
Bank and Boat Combined	227		75		49		107		458	

1987, demonstrates the value of Shasta hatchery releases to the fishery. This is also a positive indication of the ability of the Shasta strain to overwinter in the system. A 1987 release of Shasta strain rainbow could have improved catch rates, however a planned release of approximately 100,000 Shasta fingerlings in Dworshak Reservoir was cancelled due to the detection of infectious hematopoietic necrosis (IHN) at the rearing hatchery. A planned 1987 release of approximately the same number of Arlee strain fingerlings was also cancelled for the same reason.

The relative low bank angling catch rates for Kamloops strain rainbow is consistent with a strain evaluation by Cordone and Nicola (1970) that showed Kamloops to be less available to shore anglers than either Shasta, Whitney, or Virginia strains. Cordone and Nicola postulated that Kamloops occupy the open-water areas more than the littoral and limnetic zones. They also indicated that Kamloops displayed a greater tendency to leave the reservoir during periods of spillway and turbine discharge. This tendency could subject Kamloops in Dworshak Reservoir to losses through the turbines and over the spillway similar to that summarized by Horton (1981) regarding kokanee.

FOOD HABITS

Rainbow trout and bull trout ingested a variety of aquatic and terrestrial insects, in addition to Crustacea, Arachnoidea, Gastropoda, and Phyactolaemata (Bryzoa). Bait items including corn, salmon eggs, and marshmallows were also often prevalent (Table 6).

Among aquatic forms, Chironomids, Trichopterans and Odonates occurred most frequently in the samples, Terrestrial Arachnoides and Diptera were also among the more frequently occurring food items. Analysis indicated natural food items representing 31 taxa were ingested by Shasta strain rainbow, comprising 15 aquatic and 16 terrestrial forms. Kamloops utilized 22 separate taxa, identified to the same level of precision, 9 of which were aquatic and 13 of which were terrestrial.

Frequencies of occurrence of Chironomids in the diets of Shasta and Kamloops strain rainbow trout sampled were 64.7% (n=17) and 85.7% (n=7), respectively. Trichopterans occurred in 64.7% of the Shasta samples, but only 28.6% of the Kamloops. Odonates occurred in 29.4% of the Shasta samples, but did not occur in any of the Kamloops stomachs analyzed. Terrestrial spiders were detected in 47.1% of the Shasta samples and 57.1% of the Kamloops samples. Frequencies of occurrence for Cladocera in Shasta and Kamloops samples were 23.5% and 28.6% respectively. In one of two Kamloops samples containing Cladocera, this item

Table 6. Prequenciee of occurrence of food items contained in fish stomach samples taken from the creel from November 1987 through February 1988, Dworshak Reservoir, Idaho.

Taxa	Shasta Rainbow n= 17		Kamloops Rainbow n= 7		Wild Rainbow n= 1		Bull Trout n= 2	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Aranae	8	47.1	4	57.1	1	100.0	0	0.0
Amphipoda	0	0.0	0	0.0	1	100.0	0	0.0
Bryzoa	5	29.4	3	42.9	1	100.0	0	0.0
Cladocera	4	23.5	2	28.6	1	100.0	0	0.0
Coleoptera	6	35.3	3	42.9	1	100.0	0	0.0
Carabidae	0	0.0	0	0.0	1	100.0	0	0.0
Gyrinidae	2	11.8	0	0.0	0	0.0	0	0.0
Hydrophilidae	0	0.0	0	0.0	1	100.0	0	0.0
Witidulidae	1	5.9	0	0.0	0	0.0	0	0.0
Scarabidae	2	11.8	0	0.0	0	0.0	0	0.0
Staphylinidae	3	17.8	3	42.9	0	0.0	0	0.0
Diptera	13	78.5	6	85.7	1	100.0	2	100.0
Calliphoridae	0	0.0	1	14.3	0	0.0	0	0.0
Chironoridae	11	64.7	6	85.7	1	100.0	2	100.0
Culicidae	1	5.9	0	0.0	0	0.0	0	0.0
Muscidae	3	17.8	3	42.9	0	0.0	0	0.0
Mycetophilidae	1	5.9	3	42.9	0	0.0	0	0.0
Phoridae	0	0.0	1	14.3	0	0.0	0	0.0
Sarcophagidae	2	11.8	0	0.0	0	0.0	0	0.0
Sciaridae	4	23.5	1	14.3	0	0.0	0	0.0
lipulidae	2	11.8	0	0.0	0	0.0	0	0.0
Trichoceridae	2	11.8	1	14.3	0	0.0	0	0.0
Epheneroptera	1	5.9	1	14.3	1	100.0	0	0.0
Unidentified	0	0.0	1	14.3	0	0.0	0	0.0
Leptophlebiidae	0	0.0	0	0.0	1	100.0	0	0.0
Siphlonuridae	1	5.9	0	0.0	0	0.0	0	0.0
Kucopepoda	0	0.0	0	0.0	1	100.0	0	0.0
Hemiptera	5	29.4	2	28.8	0	0.0	0	0.0
Corixidae	4	23.5	1	14.3	0	0.0	0	0.0
Pyrrochoridae	1	5.9	0	0.0	0	0.0	0	0.0
Mosoveliidae	0	0.0	1	14.3	0	0.0	0	0.0
Homoptera	4	23.5	4	57.1	0	0.0	0	0.0
Aphididae	2	11.8	2	28.8	0	0.0	0	0.0
Cicadellidae	3	17.6	4	57.1	0	0.0	0	0.0
Psyllidae	1	5.9	0	0.0	0	0.0	0	0.0
Hydracarina	0	0.0	1	14.3	0	0.0	0	0.0
Hymenoptera	6	35.3	3	42.9	0	0.0	0	0.0
Apidae	1	5.9	0	0.0	0	0.0	0	0.0
Formicidae	3	17.8	0	0.0	0	0.0	0	0.0
Ichneumonidae	2	11.8	3	42.9	0	0.0	0	0.0
Prototrupidae	1	5.9	2	28.6		0.0	0	0.0

Table 6.(Continued)Frequencies of occurrence of food item contained in fish stomach samples taken from the creel from Noveaber 1987 through February 1988, Dworshak Reservoir, Idaho.

Taxa	Shasta Rainbow n= 17 Nurber	Percent	Kamloops Rainbow n= 7 Number	Percent	Wild Rainbow n= 1 Number	Percent	Bull Trout n= 2 Nurber	Percent
Lepidoptera	0	0.0	1	14.3	0	0.0	0	0.0
Neuroptera	3	17.6	2	28.6	0	0.0	0	0.0
Hererobiidae	3	17.6	2	28.6	0	0.0	0	0.0
Odonata	5	29.4	0	0.0	0	0.0	0	0.0
Cordulliidae	2	11.8	0	0.0	0	0.0	0	0.0
Libellulidae	3	17.8	0	0.0	0	0.0	0	0.0
Trychoptera	11	84.7	2	28.6	1	100.0	0	0.0
Leptoceridae	10	58.8	2	28.6	1	100.0	0	0.0
Lymnephilidae	1	5.9	0	0.0	0	0.0	0	0.0
Pulmonata	3	17.6	0	0.0	0	0.0	0	0.0
Physidae	3	17.6	0	0.0	0	0.0	0	0.0
Miscellaneous								
Corn	4	23.5	0	0.0	0	0.0	0	0.0
Debris	11	64.7	2	28.6	0	0.0	0	0.0
Marshmallows	2	11.8	0	0.0	0	0.0	0	0.0
Salmon eggs	8	47.1	2	28.6	0	0.0	1	50.0
Tuna	1	5.9	0	0.0	0	0.0	0	0.0

comprised an estimated 35% of the volume of stomach contents (300 organisms counted). The highest estimated content of Cladocera in four Shasta samples analyzed was 10% by volume (31 organisms counted).

Due to low catch rates, only 1 stomach sample was obtained for wild rainbow trout and only 2 for bull trout. No smallmouth bass stomachs were obtained during the study period.

The diverse assortment of terrestrial as well as aquatic, food items consumed by both Shasta and Kamloops strain rainbow is indicative of opportunistic feeding habits necessitated by the limited reservoir food resource. In addition to the general decrease of food production habitat caused by reservoir drawdown, aquatic drift from tributary streams is also minimal during low winter streamflows. Pettit (1976) also concluded that winter appeared to be a critical period for fish in the reservoir, and indicated that reservoir species appeared to be opportunistic and fed upon organisms as they became available.

The apparent higher utilization of Cladocerans by the Kamloops strain may reflect the pelagic nature of the strain, however, additional stomach analyses are necessary to evaluate strain differences in food habits.

SUMMARY AND CONCLUSIONS

Catch rates were generally poor through the study period, at .091 fish per hour for all species combined. An estimated 4,339 angler-hours were expended to catch 458 fish. Shasta and Kamloops strain hatchery rainbow trout provided the bulk (82.1 percent) of the catch. Bank anglers caught 93.5 percent of the Shasta strain rainbow, and 33.3 percent of the Kamloops strain rainbow.

The Shasta rainbow trout strain was the dominant strain in the creel, comprising 53.9 percent of all species and strains caught. Shasta strain rainbow trout were released in Dworshak Reservoir in June 1986, and their continued prevalence in the creel is positive indication of the strain's overwintering ability and overall suitability to the Dworshak Reservoir environment. Planned releases of approximately 100,000 Shasta rainbow trout fingerlings in late spring 1988 should substantially improve 1989 catch rates, especially for bank anglers.

The relatively low bank angling catch rates for Kamloops strain rainbow trout may reflect the pelagic nature of the strain. The 1987 releases of Kamloops rainbow trout were experimental, and no additional releases are planned in the next few years. Monitoring of the 1987 stocking will continue through the project period.

The diverse assortment of aquatic and terrestrial food items observed in trout stomach samples indicates opportunistic feeding behavior, likely caused by a limited reservoir food resource.

The apparent higher utilization of Cladocera by Kamloops strain rainbow trout, as compared to the Shasta strain, may imply a more open-water distribution. However, firm conclusions are not warranted at this time due to the small sample size.

LITERATURE CITED

Ball, K. and S. Pettit. 1974. Evaluation of limnological characteristics and fisheries of Dworshak Reservoir. Idaho Department of Fish and Game, Job Performance Report, Job 4, Boise.

Cordone, A.J. and S.J. Nicola. 1970. Harvest of four strains of rainbow trout, Salmo gairdnerii, from Beardsley Reservoir, California. California Fish and Game, 56(4) 271-287.

Falter, C.M., J.M. Leonard, J.M. Skille, F.M. Stowell, A.J. Lingg, S.J.B. Martin, and L.G. Hersman. 1979. Early limnology of Dworshak Reservoir. U.S. Army Corps of Engineers, Final Report, Contract DACW68-72-C-0142, Walla Walla, Washington.

Falter, C.M. 1982. Limnology of Dworshak Reservoir in a low flow year. Final report submitted to the U.S. Army Corps of Engineers, Walla Walla, Washington.

Horton, W.A. 1980. Dworshak Reservoir fisheries investigations. Idaho Department of Fish and Game, Job Performance Report, Contract DACW68-79-C-0034, Boise.

Horton, W.A. 1981. Dworshak Reservoir fisheries investigations; a report to the U.S. Army Corps of Engineers. Idaho Department of Fish and Game, Contract DACW68-79-C-0034, Boise.

Malvestuto, S.P. 1983. Sampling the recreational fishery. Pages 397-419 in L.A. Nielsen and D.L. Johnson, editors. Fisheries Techniques. American Fisheries Society, Bethesda, Maryland.

Miller, W.H. 1987. A review of Dworshak National Fish Hatchery mitigation record. U.S. Fish and Wildlife Service, FR-l/FAO-88-02, Ahsahka, Idaho.

Pettit, S.W. 1976. Evaluation of limnological characteristics and fisheries of Dworshak Reservoir. Idaho Department of Fish and Game, Job Completion Report, Project DSS-29-6, Job 4, Boise.

Roseberg, R.B. 1988. Personal communication. U.S. Fish and Wildlife Service, Dworshak Fisheries Assistance Office, Ahsahka, Idaho.

Wallace, R.L. and K. Ball. 1978. Landlocked parasitic lamprey in Dworshak Reservoir, Idaho. Copeia, 3: 545-546.

Appendix A, Dworshak Reservoir creel survey form.

Sections: (I)Dam-Dent Br (II) Dent Br-Grandad Br (III) Grandad Br-Upstream
Habitat Code: MR-Main Reservoir MA-Major Arms CM-Creek Mouths

	Party #										
	Date										
	Survey Site										
	Section										
	BOat or BAnk										
	Primary Sp. Sought										
	# of Anglers										
	Hrs/Angler										
	Total Hrs Fished										
	End of Trip(Y/N)										
	Residency (Y/N)										
	County or State										
Habitat Fished	MR										
	MA										
	CM										
Rate Fishing	Ex										
	Go										
	Fr										
	Pr										
	No										
Poor, Fair, Why	Sz										
	#										
	Other										
	Bait/Lure/Fly										
Catch Record (#Kept/#Released)	KOK										
	HRBU										
	HRBA										
	WRB										
	CT										
	DV										
	WF										
	EB										
	SMB										
	LMB										
	BH										
	NP										
	Other										
	Totals										

Appendix B. Angler count data sheet used in Dworshak Reservoir angler survey.

	Date	Sect.	Main Res. am	Main Res. pm	Major Arms am	Major Arms pm	Creek Mths am	Creek Mths pm	
Boat Anglers									Weekday
									Weekend
Bank Anglers									Weekday
									Weekend