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Project 8. Put and Grow
Hatchery Trout Evaluations

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JOB PERFORMANCE REPORT

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ABSTRACT

We continued hatchery trout stocking evaluations in 1994 to compare the relative returns and costs to the creel of fingerling and catchable rainbow trout *Oncorhynchus mykiss.* We included 18 lakes and reservoirs statewide in the evaluations. All were stocked with both fingerlings and catchables. We used creel censuses to estimate returns and cost to the creel, and assessed limnological characteristics, zooplankton populations, and fish community in each water.

Fluctuations in water years and reservoir levels from 1992 to 1994 have limited our ability to describe the mechanisms influencing stocking success. Catchable returns varied widely and were not related to angling effort, water levels, or other lake characteristics. Although results are speculative, fall fingerlings failed to meet return goals in all locations with extreme drawdown or where zooplankton >2.0 mm were unavailable the year of stocking. Spring fingerlings met return goals only where fish community complexity was low, although relationships with zooplankton size were poorly defined. In conjunction with future stocking evaluations, we should use standardized lowland lake surveys to describe relative abundance of competitors and predators in hatchery trout waters.

We also continued monitoring two trophy trout reservoirs, Daniels and 24-Mile. Stocking rates were reduced in both in 1992. Based on electrofishing samples, fish condition and size structure have improved since 1992. Trout size structure in both populations exceeds the management goal, although few legal fish (>508 mm, 20") are harvested. Catch rates remain acceptable despite reduced stocking rates.

Stocking rates for trophy trout waters should be no more than half the rate used for similarly productive yield fisheries. We have little information on other waters managed for trophy trout in Idaho. Assembling more comprehensive data on additional trophy fisheries would assist in refinement of stocking rate guidelines for these waters.

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INTRODUCTION

Rainbow trout *Oncorhynchus mykiss* are the most popular game fish in Idaho (Reid 1989). In 1987, an estimated 26% of all angling effort in Idaho was directed at trout in lowland lakes and reservoirs. Most of these fisheries are supported by hatchery plants of fingerling and catchable-size fish. About 75% of the catchables and 90% of the fingerling rainbow trout produced by Idaho Department of Fish and Game (IDFG) hatcheries are stocked in lowland lakes and reservoirs, and hatchery trout provide much of the consumptive harvest opportunity in these waters. Hatchery programs are expensive, however. The annual resident hatchery budget ($2.65 million) represents about 35% of the annual resident fisheries budget.

The dependence of many lake and reservoir fisheries on hatchery trout, and the cost of the hatchery program, make it important to maximize stocking efficiency. This means determining the best size of fish, number, and time of year to stock to optimize harvest and creel returns in each water. In the past, few stocking evaluations in Idaho compared the relative returns of fingerling and catchable-size fish in lakes and reservoirs (Dillon and Megargle 1994). Stocking strategies are based on the experience and trial-and-error of individual fisheries managers. As with most other states, IDFG has no standardized approach to determine appropriate stocking strategies. There are return targets for put-grow-and-take fisheries (100% by weight) and put-and-take fisheries (40% by number; IDFG 1990), but it is unclear how often we meet these objectives.

In 1992, IDFG began new statewide stocking evaluations aimed at better defining the tradeoffs between fingerling and catchable trout stocking strategies in Idaho lakes and reservoirs. We also included data from evaluations begun in 1990 and 1991 on two waters. These evaluation data, along with additional data to be collected through 1997, will be used to develop statewide trout stocking guidelines based on lake and reservoir characteristics and angling effort. This report documents progress toward that goal through 1994.

IDFG manages most hatchery-supported waters as consumptive trout fisheries, but also manages ten lakes and reservoirs for trophy trout. These are also stocked with various combinations of fingerlings and catchables. Regulations restrict harvest, with a two-fish >20 in (508 mm) bag limit and artificial lures and flies with single barbless hooks only. The objective of the regulation is to reduce angling mortality and provide increased catch rates with at least 20% of the fish caught >16 in (406 mm) (IDFG 1991). Evaluations of stocking strategies, angler use, and fish population size structure have been limited to a few waters, including two in the current study.

In two trophy trout waters evaluated in 1992-1993, Daniels and 24-Mile reservoirs, fish population size structure exceeded the management objective (Dillon and Jarcik 1994), but legal fish were extremely rare in electrofishing samples. In 1993, estimated legal harvest was 28 fish in Daniels and zero in 24-Mile (IDFG unpublished data). In both, fish growth was moderate and condition (relative weight) was poor compared to nearby yield fisheries (Dillon and Jarcik 1994), suggesting that reducing fish densities could improve growth and possibly production of legal fish. Stocking rates in these two waters have been reduced since 1992 to half those of nearby yield fisheries.

We continued our evaluation of fish populations in Daniels and 24-Mile reservoirs in 1994 to monitor the effect of reduced stocking rates on survival, growth, population size structure, catch rates, and yield of legal fish. Describing relationships among these variables should help us manage these and other trophy fisheries more effectively.

PROJECT GOAL

To maximize the effectiveness of trout stocking programs in Idaho's lake and reservoir fisheries.

OBJECTIVES

1. Describe growth, returns, and cost per fish in the creel for fingerling and catchable rainbow trout in select waters statewide.

2. Describe relationships among lake and reservoir characteristics and performance of stocked rainbow trout.

3. Describe general characteristics of successful fingerling rainbow trout stocking programs.

4. Describe relationships among angling effort, stocking rate, growth, and return of stocked fingerling and catchable rainbow trout.

5. Develop stocking guidelines for fingerling rainbow trout in Idaho lakes and reservoirs.

6. Develop hatchery fish evaluation guidelines for lakes and reservoirs.

STUDY AREA

From 1992 to 1994 we evaluated stocking programs on nine study waters including two trophy waters, Daniels and 24-Mile (Figure 1). We also compiled data from regional fisheries personnel for evaluations on another eight waters. These waters represent a broad range of conditions (productivity, habitat, species composition, and angling intensity).

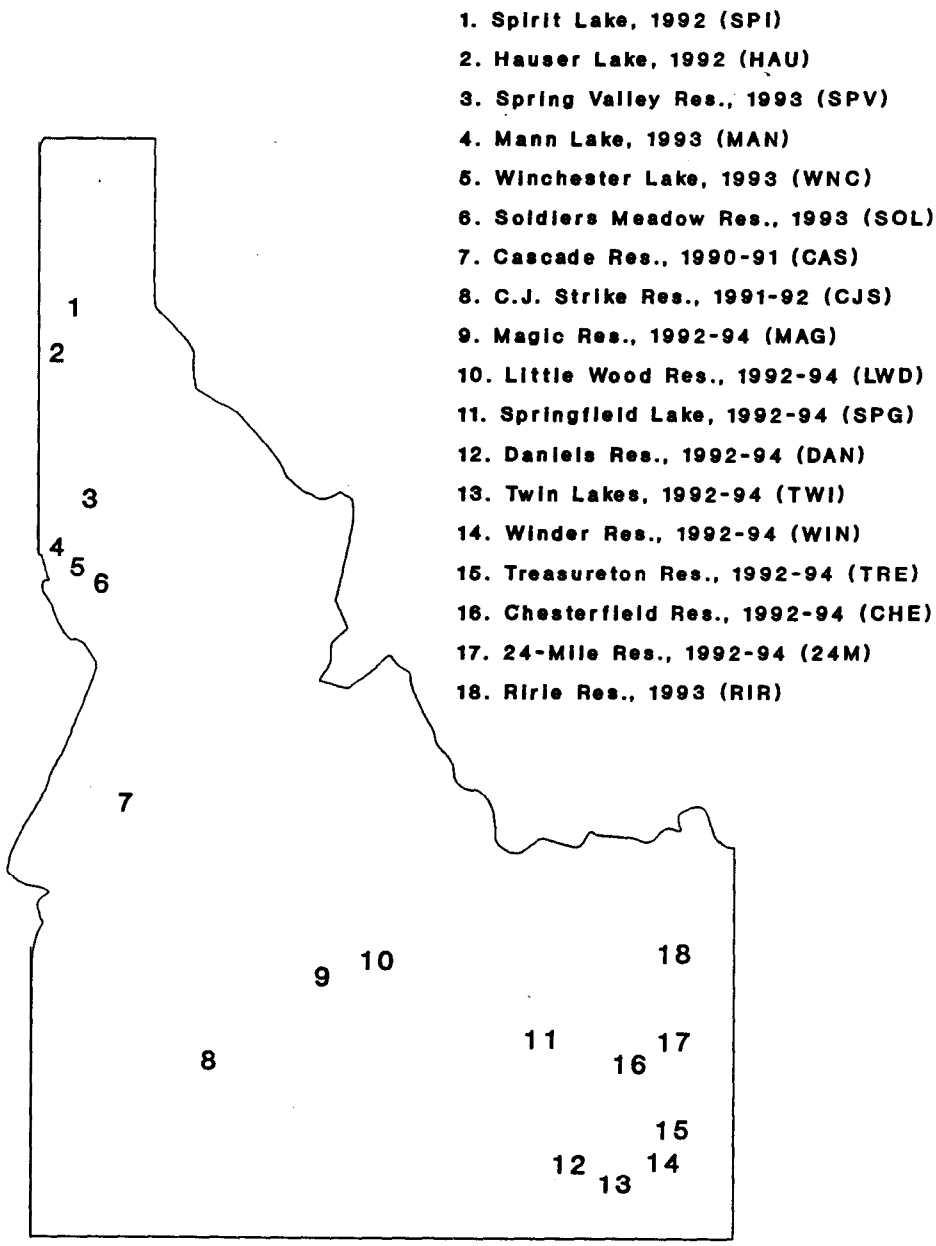

Figure 1. Locations and years of study waters with fingerling/catchable stocking evaluations. Abbreviations () used in subsequent tables and figures.

METHODS

Fingerling-Catchable Tradeoffs

Stocking

Stocking rates, sizes, and marking varied with management strategies for individual waters (Table 1). Each study water received catchable-size (200-250 mm total length) fish. Fingerlings were stocked in the spring (75-100 mm), in the fall (125-175 mm), or both.

In the Magic Valley and Southeastern Region waters, we estimated mean size at stocking by measuring total length (mm) of 100 fish prior to stocking (Table 1). In the remaining waters, mean size at stocking was approximated from pound counts. In twelve waters, various combinations of maxillary clips, fin clips, and dye marking were used to identify year and size at planting (Table 1). Fingerlings were marked only when we needed to differentiate between spring and fall releases, or to identify different strains stocked at the same time. In the remaining waters fingerlings and catchables in the creel were differentiated by size and fin erosion patterns.

Contribution to the Creel

To monitor total returns and contribution to the creel through 1994, complete randomized creel censuses were developed for each fishery (McArthur 1993). Creel clerks were instructed to check for marks and record lengths (mm) and weights (g) of harvested fish.

We used return estimates developed from creel census data and planting records, along with hatchery rearing and planting costs, to estimate cost per fish harvested from each stocked group and lake. Stocking costs for catchable-size fish were based on a statewide average of $0.54/fish (IDFG unpublished data; Appendix A). No stocking cost estimates were available for spring or fall fingerling rainbow trout. We used the mean cost per kilogram of catchable fish ($3.58/kg; IDFG unpublished data) to estimate costs per spring and fall fingerling at $0.05 and $0.12, respectively. We calculated cost per fish in the creel as the stocking cost per fish divided by the return rate.

Growth and Condition

To describe relationships between fish growth and returns, we sampled nine waters monthly (May to October) by electrofishing to monitor growth and condition of stocked fish. We estimated growth through October by comparing mean length at capture to mean length at stocking for each stocked group. Growth of spring-planted fish through October was

Table 1. Rainbow trout stocking data for 18 Idaho waters with fingerling-catchable stocking evaluations (IDFG hatchery records).

Location	Year	Number of catchables stocked	Date	Mean length (mm)	ID mark°	Number of fingerlings stocked	Date	Mean length (mm)	ID mark[a]
Spirit Lake	1992	7,000	4-6/92	243	AC	45,000	10/92	136	NM
Hauser Lake	1993	9,000	4-6/92	243	AC	18,000	10/92	136	NM
Cascade Reservoir	1990	0	--	--	--	169,000	9/90	165	LV
	1991	150,000	6/91	250	RM	100,000	5/91	114	NM
C.J. Strike Reservoir	1991	0	--	--	--	26,390	12/91	140	NM
	1992	0	--	--	--	7,875	3/92	203	NM
Magic Reservoir	1992	33,850	5/92	224	LM	201,400	4/92	83	NM
	1993	36,400	5/93	221	RM	387,050	4/93	120	AC
						216,345	10/93	131	NM
	1994	24,975	5/94	201	LM	50,170	9/94	123	AC
Little Wood Reservoir	1992	7,600	4/92	229	LM	54,000	4/92	80	NM
	1993	10,113	5/93	250	RM	45,600	5/93	78	NM
						54,000	10/93	125	AC
	1994	10,000	5/94	253	LM		5/94		NM
							9/94		AC
Spring Valley Reservoir	1992					10,000	Fall	150	NM
	1993	45,000	4-10/93	250	NM	20,000	6/93	75	NM
Mann Lake	1993	42,290	4-10/93	250	NM	45,000	6/93	75	NM
Winchester	1992	--	--	--	--	10,000	Fall	150	NM
	1993	42,288	4-10/93	250	NM	30,000	6/93	82	NM
Soldiers Meadow Reservoir	1993	15,070	4-10/93	250	NM	25,000	6/93	75	NM
Springfield Lake	1992	3,073	2/93	264	AC	25,008	10/92	157	NM
		2,000	5/92	239	AC	--	--		
		1,680	6/92	244	AC	--	--		
	1993	8,500	5/93	254	LM	25,000	10/93	160	NM
	1994	4,690	5/94	240	RM	25,000	10/94	160	NM

Table 1. (Cont.)

Location	Year	Number of catchables stocked	Date	Mean length (mm)	ID Mark[a]	Number of fingerlings stocked	Date	Mean length (mm)	ID Mark[a]
Daniels Reservoir	1992	4,690	3/92	196	AC	15,829	9/92	162	NM
	1993	4,688	5/93	229	LM	15,951	10/93	127	NM
	1994	4,690	5/94	218	RM	15,900	10/94	165	NM
Twin Lakes	1992	11,076	5/92	244	AC	37,630	9/92	163	NM
	1993	11,141	5/93	229	LM	37,637	9/93	152	NM
	1994	11,150	5/94	230	RM	0	--	--	--
Winder Reservoir	1992	13,198	5/92	241	AC	9,944	9/92	160	NM
	1993	2,349	5/93	229	LM	6,450	9/93	127	LM
	1994	2,350	5/94	230	RM	--	--	--	--
Treasureton Reservoir	1992	15,960	5/92	239	AC	0	--	--	--
	1993	16,002	5/93	229	LM	54,060	9/93	152	NM
	1994	1,200	5/94	230	RM	--	--	--	--
Chesterfield Reservoir	1992	20,000	3/92	193	AC	134,995	9/92	160	NM
	1993	39,995	5/93	229	LM	129,850	9/93	165	NM
	1994	40,000	5/94	230	RM	--	--	--	--
24-Mile Reservoir	1992	1,136	5/92	244	AC	1,859	9/92	160	NM
	1993	550	5/93	229	LM	1,860	9/93	152	NM
	1994	550	5/94	230	RM	1,860	9/94	165	NM
Ririe Reservoir	1992					162,530	--	134	NM
	1993	12,019	4/93	305	NM	0	--	--	--

[a] AC = adipose clip; NM = not marked; LV = left ventral clip; RV = right ventral clip; RD = red dye mark; OD = orange dye mark; GD = green dye mark; RM = right maxillary clip; LM = left maxillary clip.

expressed as mm/day. Growth of the previous year's fall fingerlings was expressed as mm/year.

We used relative weight (Wr) (Anderson 1980) to describe average monthly condition of sampled fish. We calculated individual relative weights as:

$$Wr = \frac{\text{Observed Weight}}{\text{Standard Weight}} \times 100$$

Standard Weights (Ws) were based on the formula:

$$\text{LogWs} = -5.194 + 3.098\text{LogL}$$ (Anderson 1980)

where L = total length (mm)

Lake Characteristics

To describe the influence of lake characteristics on rainbow trout growth and returns we collected basic limnology, morphometry, and species composition data for each water. Limnology sampling frequency varied by year and location, but included the following:

1. Total phosphorous
2. Alkalinity
3. Total dissolved solids
4. Conductivity
5. Temperature and oxygen profiles
6. Secchi disk transparency
7. Zooplankton species composition and size structure

Sampling and analysis methods are reported in detail in Dillinger et al. (1993).

To evaluate effects on return of interannual water level fluctuations, we subjectively categorized reservoirs into three groups: 1) reservoir locations and years with extreme drought and drawdown, 2) those with average water recharge and moderate drawdown, and 3) those with above average recharge and little or no drawdown, or natural lakes with stable water levels. We used the presence or absence of potential predators and competitors as categorical data in the analysis.

We used temperature and oxygen profiles to describe useable trout habitat (UTH) and maximum trout habitat (MTH) in each water. We defined UTH as water with temperatures ≤19°C and oxygen ≥5 mg/l (Heimer and Howser 1990), and defined MTH as water with temperatures ≤21°C and oxygen .3 mg/l (after Van Velson 1986).

Analysis

We used correlation analysis to initially examine relationships among variables representing lake productivity, water levels, angling effort, fish community, trout growth, and return rates. Those variables correlated with a chosen dependent variable (e.g. growth, return to creel) were used in regression analysis to test for relationships among lake characteristics and return data for each stocked group. We used Fisher's exact test to test relationships between zooplankton size structure and trout stocking success.

Trophy Trout Evaluations

In addition to routine creel census and sampling for growth and condition data, we sought survival estimates for fish stocked in the two trophy waters, Daniels and 24-Mile reservoirs. These waters have a 20-in (508 mm) minimum length regulation. We assumed, therefore, that none of the fish planted in May (235 mm) and September (127 mm) of 1993 were harvested prior to our sampling. Also, few or none of the 1992-stocked fish were of legal size in May of 1994. Abundance of these stocked groups in 1994 should primarily reflect natural and catch-and-release hooking mortality over the previous 1.5 to 2 years.

Prior to stocking the 1994 catchables, we electrofished for two nights on Daniels Reservoir and one night on 24-Mile Reservoir. We noted fin or maxillary clips, recorded lengths, and marked all captured fish with a caudal fin punch. The 1994 catchables were stocked 2 d later. We did recapture runs 8 d after the marking runs.

We estimated abundance of 1992- and 1993-stocked fish, and other trout, by two methods. The first was the standard Peterson approach (Ricker 1975) using the above electrofishing captures as marked fish. We then calculated a one-sample estimate using the 1994-stocked catchables as the marked group (Hepworth et al. 1991) with the following formula:

$$N = \frac{(M + 1)(C + 1)}{(R + 1)} - M$$

where M = number of newly stocked fish
C = number of other fish sampled in the recapture run + R
R = number of newly stocked fish recaptured

Confidence intervals on the one-sample estimates were determined by using table values for 95% limits of R, based on a Poisson frequency distribution (Ricker 1975). We used Chi-square analyses to test for significant size structure differences (% of fish ≥406 mm) among years in both Daniels and 24-Mile reservoirs.

We expressed survival to May 1994 for 1992- and 1993-stocked fish as a percentage of the number stocked for each group. At the time of the estimate, 1992 catchables had been in the reservoir for two years and 1993 catchables one year. The 1992 fall fingerlings had been in the reservoir for 20 months and the 1993 fall fingerlings 8 months. We estimated standing

stock (kg/hectare) for each group using a mean weight from the total electrofishing catch of that group. We excluded the newly stocked fish from our estimates of total standing stock.

For Daniels Reservoir, we examined the potential mortality related to catch and release fishing. Due to uncertainties in 1994 population estimates, we used the 1993 total catch estimate (23,000 fish) and total population estimate (4,400 fish, all stocked groups combined; Dillon and Jarcik 1994) to approximate the average number of times each fish in the population was caught and released in 1993. We assumed that hooking mortality for barbless lure- and fly-caught fish was 5% (Wydoski 1977). Because we had no data on catchability of different sizes, we assumed that all stocked groups were caught in proportion to their abundance in the population. We used the results to describe whether catch-and-release hooking mortality could represent a significant limitation to population size structure in Daniels or other waters with length limit regulations and gear restrictions.

Sampling in Daniels Reservoir in 1994 indicated some natural recruitment, with up to 18% of the electrofishing catch comprised of juvenile wild cutthroat or rainbow x cutthroat hybrids. On September 7, 1994 we sampled a 100-m stretch of Malad Spring above the reservoir to determine if this stream is a significant source of natural recruits.

RESULTS

Fingerling Catchable Tradeoffs

Contribution to the Creel

Creel census effort estimates for each water are provided in Appendix B. In waters with multiple-year evaluations, returns of both fingerlings and catchables were variable both within years among lakes and within lakes among years. Catchables met return goals (40% by number) in 11 of 28 evaluations (Figure 2). Returns in several other waters approached the goal, and 17 of 28 exceeded 33% returns. These waters are managed as put-grow-and-take fisheries, however, rather than put-and-take fisheries. We will include estimates of return by weight in future analyses. Spring fingerlings met return goals for put-grow-and-take fisheries (100% by weight) in 4 of the 8 plants (Figure 3), while fall fingerlings met return goals in 5 of the 15 plants (Figure 4).

Cost per fish in the creel also had high interannual variability for all three size groups. For catchables, cost per harvested fish ranged from $0.68 (three locations) to over $500 in Springfield Lake (Appendix C). Spring fingerling costs ranged from $0.10 to $6.67 per harvested fish, and fall fingerlings from $0.34 to $120.00 per harvested fish.

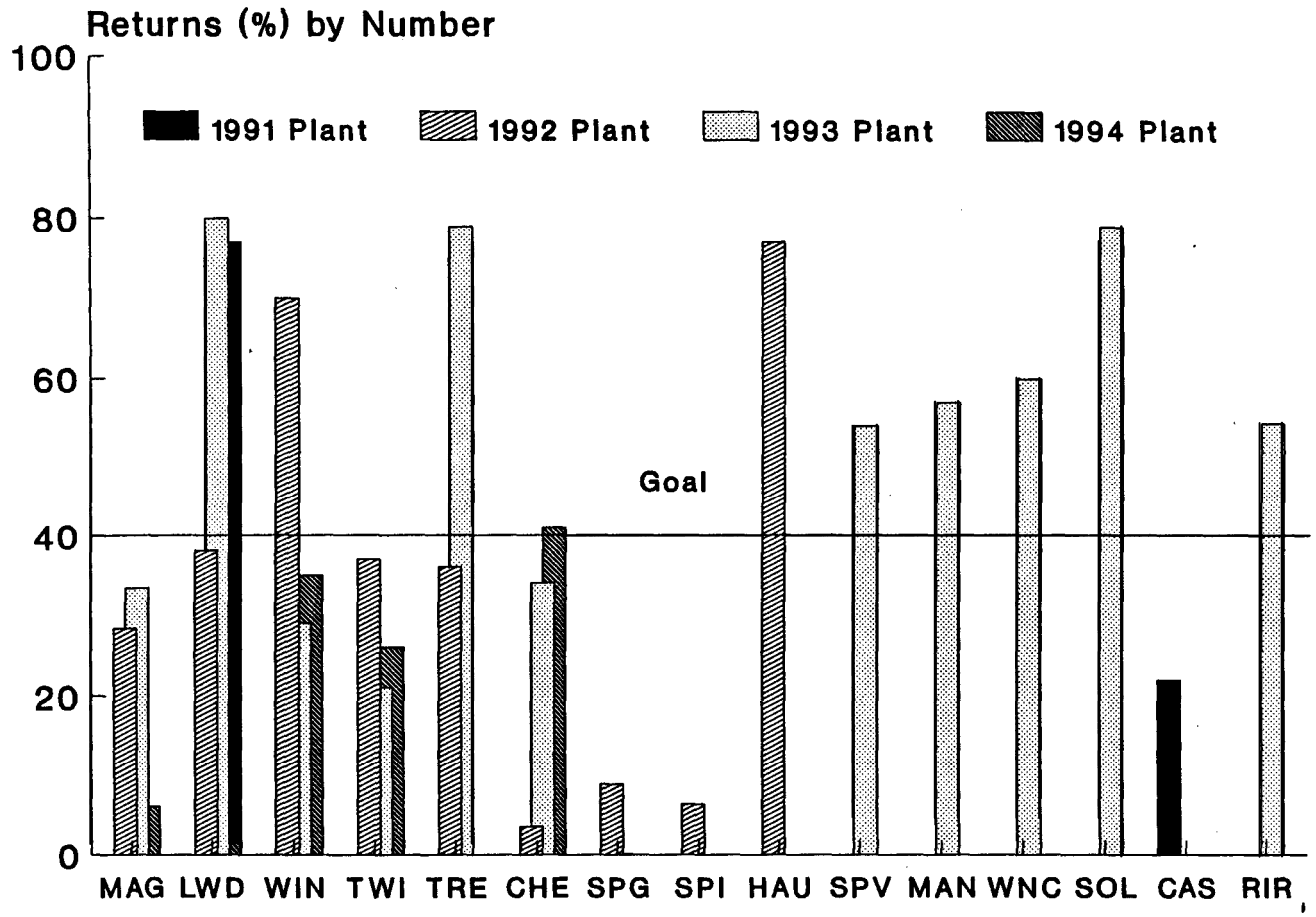

Figure 2. Returns of catchable rainbow trout in 15 Idaho lakes and reservoirs, 1991-1994.

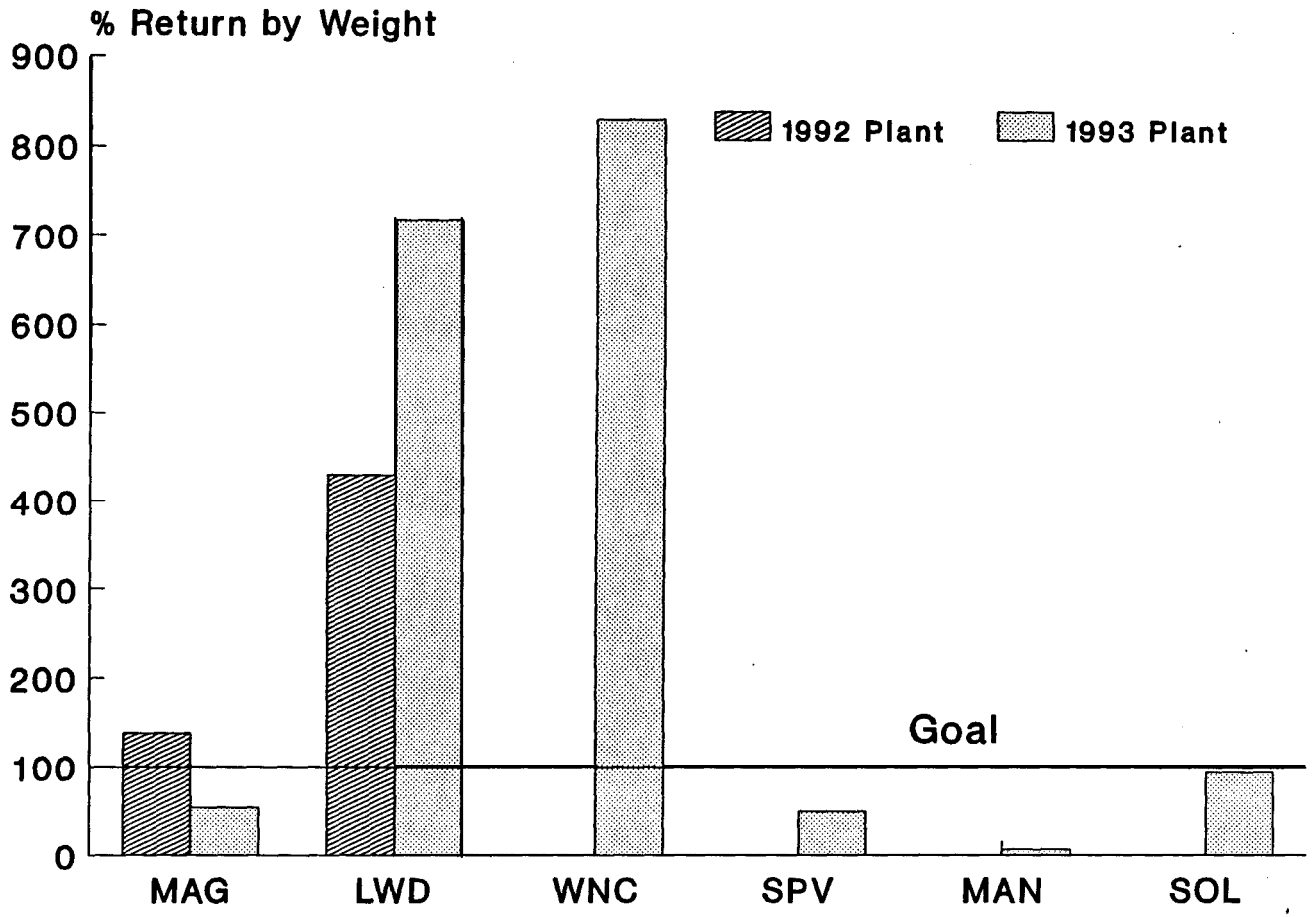

Figure 3. Weight returns for spring fingerling rainbow trout in six Idaho lakes and reservoirs.

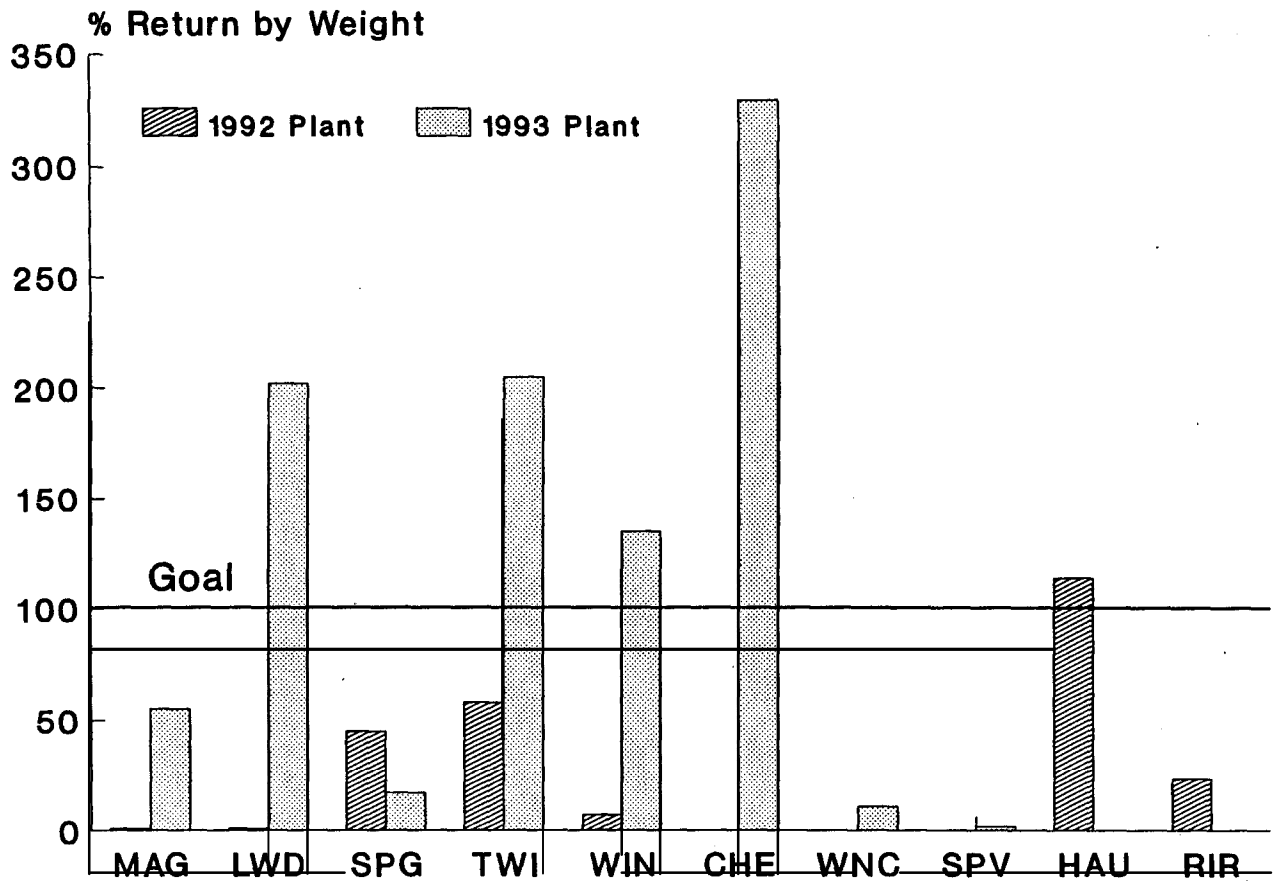

Figure 4. Weight returns for fall fingerling rainbow trout in ten Idaho lakes and reservoirs.

Growth and Condition

In the multiple-year study waters, growth of catchables was poorer in the drought year of 1994 than in the high water year of 1993 (Appendix D-1), probably reflecting reduced carrying capacities in the study waters during the drought year. Similar trends were observed for fall fingerlings (Appendix D-2) and spring fingerlings (Appendix D-3). Trends in average fish condition (Wr) generally followed those of growth. In 1994 in all waters with monthly data available, mean Wr declined dramatically from May to September (Appendix E). Under the higher water levels of 1993, fish generally maintained body condition throughout the May to October sampling period (Dillon and Jarcik 1994).

Lake Characteristics

Available limnological data and species composition for each study water are presented in Appendix F. Not all limnological data were collected in each water and year. In the multiple-year study waters, basic indices of primary productivity (e.g. Secchi disk transparency) changed little from year to year, despite tremendous interannual variation in water levels.

In most waters with year-to-year comparative data, zooplankton length-frequencies shifted to smaller sizes in the low water years of 1992 and 1994 compared to the high water year of 1993 (Appendix G). Five waters (Spirit, Spring Valley, Mann, Soldiers Meadow, and Ririe) showed evidence of severe zooplankton cropping as would be evidenced by few or no specimens larger than 1.5 mm (Appendix H). Additional zooplankton samples from Winder, Treasureton, and Chesterfield reservoirs in 1993 and 1994 were not analyzed in time for inclusion in this report.

As in 1993, UTH was not a limitation to most of the fisheries with available data, i.e. most contained water ≤9°C with dissolved oxygen 2.5 mg/liter (Appendix I). The exception in 1994 was Twin Lakes, where early July epilimnial temperatures exceeded 19°C, and hypolimnial oxygen concentration was below 2 mg/l. No fish kill was observed in Twin Lakes, however, and by early August, the entire water column was UTH again.

Analysis

With the current data set, there were few significant correlations among lake productivity, species composition, angling effort, fish growth, or return variables. The categorical variable reflecting water level at the time of stocking was positively correlated with returns for fall fingerlings. This was true for both numerical returns ($R2 = .357$, $p = .015$) and weight returns ($R2 = .308$, $p = .032$). Although these relationships were statistically significant, water level at planting accounted for only a small portion of the variability in returns. None of the other variables reflecting productivity, water levels, or angling effort were significantly correlated with returns.

Zooplankton sampling effort and timing varied across the study waters, thus samples were not directly comparable. Presence or absence of zooplankton ≥ 2.0 mm was significantly related to fall fingerling stocking success (Fisher Exact Test, p = .02). In all five waters where fall fingerlings met return goals, zooplankton ≥ 2 mm were present in our samples the year of planting (Table 2). In seven out of ten unsuccessful fall fingerling plants, we sampled no zooplankton ≥ 2 mm the year of planting.

Trophy Trout Evaluations

In 1994 as in 1993, electrofishing capture rates in 24-Mile Reservoir were too low to derive population estimates using either method. Survival estimates were therefore not feasible.

In both Daniels and 24-Mile reservoirs, 1994 fish population size structure (based on electrofishing samples) exceeded the management goal for trophy fisheries (Figures 5, 6). Size structure in both has improved since stocking rates were reduced in 1992. In Daniels, the proportion of fish >406 mm (16 inches) in fall electrofishing samples increased significantly from 42% in 1992 to 54% in 1993 (Chi-square, $p<.05$; Figure 5) and essentially unchanged (56%) in 1994. In 24-Mile, fall size structure increased from 22% >406 mm in fall 1993 to 58% in fall 1994 (Chi-square, $p<.05$; Figure 6). Growth in both reservoirs has varied with the water year, but average condition (Wr) in the fall has also improved since 1992 (Appendix J-1, J-2).

Average season catch rates in Daniels remained high in 1993 (.56 fish/hr) and 1994 (.63 fish/hr; Table 3). In 1994, catch rates were significantly lower in 24-Mile than in Daniels based on the absence of overlapping confidence intervals. Total effort on Daniels declined significantly from 1993 to 1994 (Table 3).

The 1994 population estimates derived from the two methods were considerably different for most groups of fish in Daniels Reservoir (Table 4). Recapture rates for all groups except 1993 fall fingerlings were low compared to the recapture rate for 1994 catchables (Appendix K). This is in contrast to 1993, when recapture rates were similar for caudal-punched fish and newly-stocked fish (Dillon and Jarcik 1994). Because we had too few or no marked recaptures for 1992 or 1993 catchables, cutthroats, or hybrids, population estimates for these groups were not possible with the Peterson method. Confidence intervals were smaller on the one-sample estimates because of the high recapture rates for newly-stocked fish.

Total fish density and standing stock estimates for Daniels Reservoir varied in accordance with population estimates, and were lower than the 1993 estimates (Table 4). However, we had no recaptures from several groups of fish in 1994 and would expect the total estimate to be lower. Also, because recapture rates were higher for 1994 catchables than for most other groups, the one-sample population estimates may be negatively biased.

Estimated survival rates for 1992- and 1993-planted fish are presented in Table 5. Although confidence limits are wide for some estimates, survival of both years' planted fish was relatively poor. Of the 20,500 fish planted in 1992, we estimated less than 1,000 were alive in May of 1994.

Table 2. Relationship of water level and zooplankton size structure to the success of fall fingerling rainbow trout stocking in Idaho lakes and reservoirs. For water level indices, 1 = extreme drawdown, 2 = moderate drawdown, and 3 = minimal drawdown or stable water levels. The zooplankton index indicates presence (Y) or abscence (N) of zooplankton > 2.0 mm the year of stocking.

	Water Index								
	1			2			3		
Weight return	Location/ year		Zooplankton index	Location/ year		Zooplankton index	Location/ year		Zoopplankton index
>100%	None			WIN	1993	Y	LWD	1993	Y
							TWI	1993	Y
							CHE	1993	Y
							HAU	1992	Y
<100%	MAG	1992	N	TWI	1992	N	MAG	1993	Y
	LWD	1992	N				SPG	1992	Y
	WIN	1992	N				SPG	1993	Y
	RIR	1992	N				SPV	1992	N
							WNC	1992	N

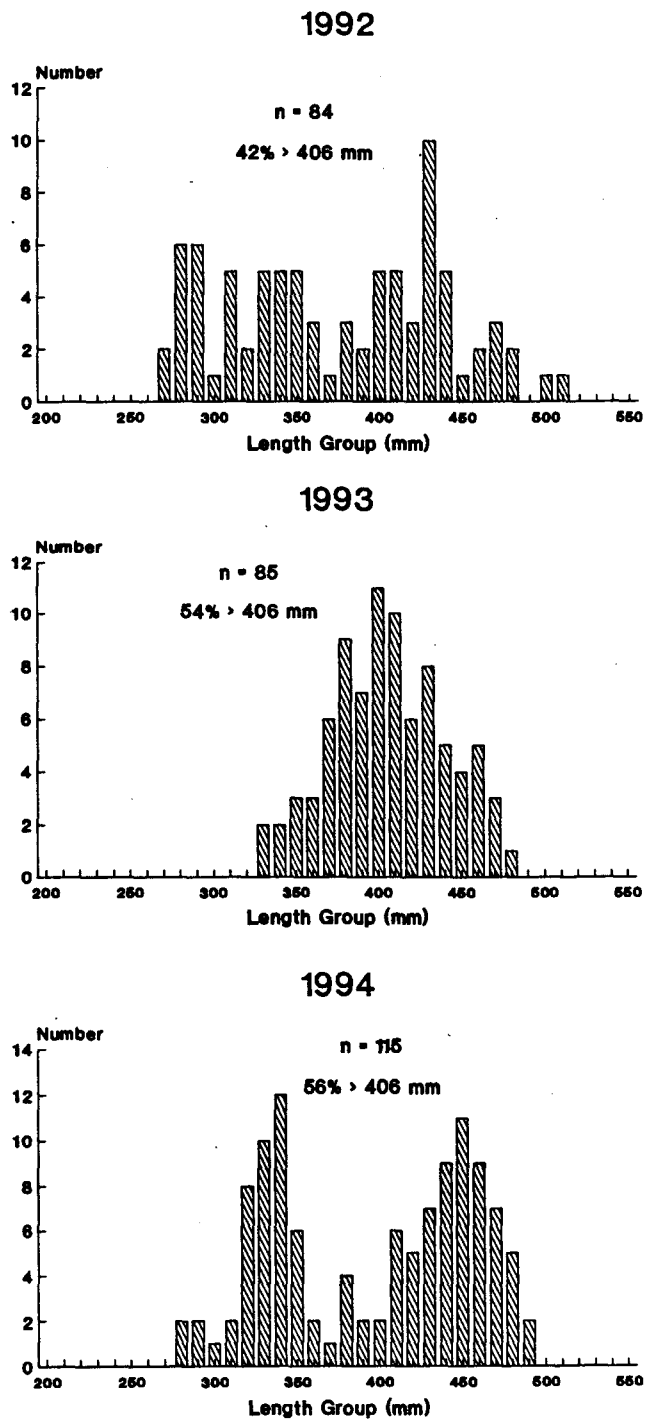

Figure 5. Electrofishing length-frequencies and proportions of trout over 406 mm (16 inches) in Daniels Reservoir, fall 1992, 1993, and 1994.

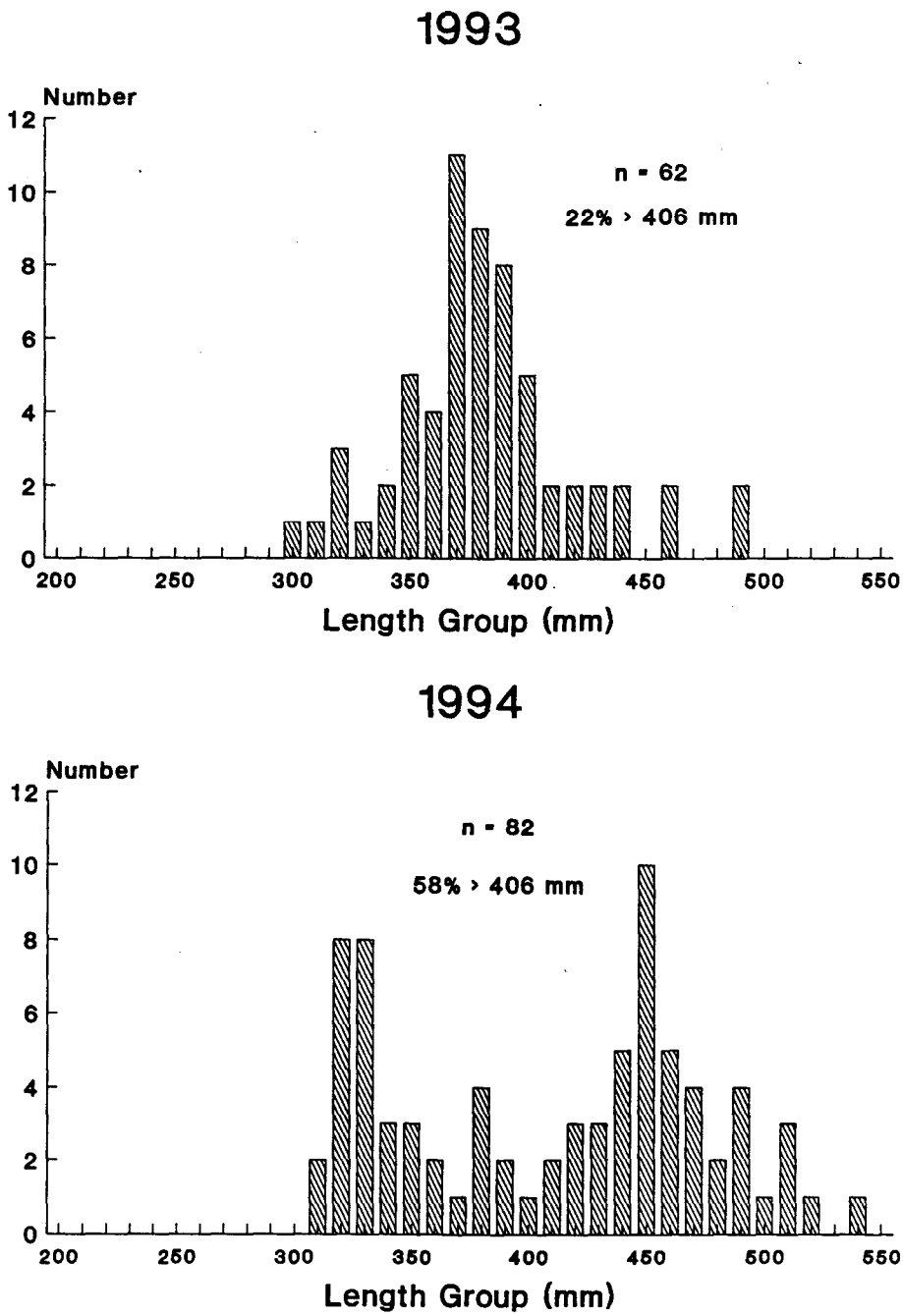

Figure 6. Electrofishing length-frequencies and proportions of trout over 406 mm (16 inches) in 24-Mile Reservoir, September 1993 and 1994.

Table 3. Total effort, catch, and catch rate estimates (±95% confidence limits) for Daniels and 24-Mile reservoirs, 1993 and 1994.

	1993				1994			
	Total effort (hour)	Hours/ hectare	Total catch	Catch rate (fish/ hour)	Total effort (hour)	Hour/ hectare	Total catch	Catch rate (fish/ hour)
DAN	41,173	271.	23,035	.56	27,229	179	.20,723	.63
	(±7,281)	(±50)	(±5,446)	(x..13)	0.4,812)	(±32)	(±5,279)	(±16)
24M	7,627	428	2,831	.37	4,571	257	2,198	.31
	(±2,290)	(±129)	(±1,201)	(±16)	(±1,616)	(±91)	(±1,092)	(±15)

Table 4. Population and biomass sample estimates for Daniels Reservoir, May, 1993 and 1994, using standard mark-recapture methods (M-R) and one- sample (O-S) estimates with newly stocked fish as a marked group.

Year of estimate	Method	Fish group	Population estimate	Mean weight (g)	Density Fish/ hectare	Density Kg/ hectare
1993	M-R	Spring 1992 catchables	224	399	1.5	0.8
		Fall 1992 fingerlings	2,392	122	15.7	1.9
		Unmarked rainbow trout	1,554	600	10.2	6.1
		Cutthroat x rainbow hybrids	218	572	1.4	0.6
		Cutthroat	no est.	-	-	
		Totals	4,388	-	28.8	9.4
	0-S	Spring 1992 catchables	279	399	1.8	0.7
		Fall 1992 fingerlings	1,372	122	9.1	1.1
		Unmarked rainbow trout	2,271	600	14.6	8.7
		Cutthroat x rainbow hybrids	301	572	1.9	1.1
		Cutthroat	194	679	1.2	0.8
		Totals	4,417		28.6	11.7
1994	M-R	Spring 1992 catchables	no est.	825		
		Fall 1992 fingerlings	715	776	4.8	3.7
		Spring 1993 catchables	598	738	4.0	2.9
		Fall 1993 fingerlings	1,719	152	11.3	1.7
		Cutthroat x rainbow hybrids	no est.	826	-	-
		Cutthroat	no est.	331	-.	_
		Totals	3,032		20.1	8.3
	0-S	Spring 1992 catchables	21	825	0.1	0.1
		Fall 1992 fingerlings	372	776	2.4	1.9
		Spring 1993 catchables	245	738	1.6	1.2
		Fall 1993 fingerlings	2,024	152	13.3	2.0
		Cutthroat x rainbow hybrids	99	826	0.7	0.5
		Cutthroat	188	3 . 1	J . 1	52.4
		Totals	2,949		19.3	6.1

Table 5. Estimated survival (±95% confidence intervals) through May 1994 for catchable and fall fingerling rainbow trout planted in Daniels Reservoir in 1992 and 1993.

Size stocked	Date stocked	Number stacked	Estimated survival (%) to May 1993		Estimated survival (%) to May 1994	
			M-R°	O-S[b]	M-R[a]	O-S[b]
196mm	3/92 (±4.1)	4,690 (±2.9)	4.8	5.9	-	0.4
162mm	9/92 (±14.6)	15,829 (I:1.5)	15.1 (±3.1)	8.7	4.5	2.4
229mm	5/93 (±13.8)	4,688	- -	-	12.8	5.2
127mm	10/93 (±5.6)	15,951		-	10.8	12.7

[a]M-R = standard Peterson estimate
[b] O-S = one-sample estimate

Based on the spring 1994 population estimates, surviving fish from the 1992 and 1993 plants were 77% to 91 % fall fingerlings and only 9% to 23% catchables.

Based on the 1993 catch (23,000 fish) and population (4,400 fish) estimates, anglers caught each fish in Daniels Reservoir an average of about five times. This is likely a worst-case overestimate since the population estimate did not include 1993-planted catchables (n = 4,688). If we include these and assume 100% survival through the 1993 season, each fish in the population would be caught about 2.3 times on average.

At 5% hooking mortality, an estimated 1,150 fish could have died due to catch-and-release fishing (23,000 x .05). This represents about 13% and 26% exploitation from hooking mortality in the best-case and worst-case scenarios, respectively.

In a 100 m section of Malad Spring above Daniels, we sampled 144 juvenile salmonids (Appendix M). Almost all had cutthroat or rainbow x cutthroat hybrid characteristics. These fish were natural recruits, apparently offspring of cutthroat or hybrids planted in the reservoir before 1992.

DISCUSSION

Fingerling Catchable Evaluations

The extremely variable water years from 1992 to 1994 have not provided the consistent conditions under which we could rigorously evaluate stocking strategies. Where we have multiple-year data on individual waters, returns have been inconsistent. The result is a database that is, for the most part, not amenable to statistical analysis and interpretation. Despite the statistical limitations, however, we can begin to draw some conclusions from the data.

The influences of water levels and drawdown regime on returns are probably both direct and indirect. They are most evident with the current data for fall fingerlings. When planted in drought years, returns were generally poor (only one of five plants under these conditions met return goals). In Winder Reservoir, fall fingerlings met return goals under moderate drawdown conditions (1993 plant) but not under extreme drawdown (1992 plant). In natural lakes and in reservoirs with minimal drawdown, fall fingerlings met return goals in four out of ten cases. Other than zooplankton size distribution, there were no obvious differences in lake characteristics between successful and unsuccessful plants. Almost all contained potential predators and competitors, although relative abundance of these among lakes is unknown.

Describing relative abundance rather than presence/absence of predators and competitors in the evaluation waters could provide additional perspective on the mechanisms affecting returns. Our standardized lowland lake surveys generate species composition and catch rate data that could be compared across waters. Using catch rate data to describe relative abundance has some important statistical limitations (Dillon 1989). Regardless, we should include lowland lake surveys in new or ongoing stocking evaluations, and include estimates of predator and competitor relative abundance in the analyses.

The three cases where fall fingerlings were unsuccessful even with large zooplanktors available were Magic Reservoir (1993 plant) and Springfield Lake (1992 and 1993 plants). The circumstances in these two locations were unique. The 1993 fall fingerlings survived well in Magic, and comprised about half of the 1994 harvest. Due to drought conditions in 1994 the reservoir was almost completely drained by late summer, however. Sampling below the reservoir indicated many fish were lost by entrainment. Had the 1994 water conditions been better, total returns of fall fingerlings would probably have met goals.

Springfield Lake has had poor returns of all catchable and fingerling plants since 1992. Poor returns are probably not related to water quality problems; the fish harvested in the lake show remarkable growth (Dillon and Jarcik 1994). Predation by migratory birds (predominantly cormorants) could account for most of the catchable losses (IDFG unpublished data). Fall fingerlings apparently move out of the main lake and up into the spring inlets shortly after stocking (Dick Scully, IDFG, personal communication), possibly seeking the warmer spring water. They remain there all winter and are vulnerable to predation and starvation.

Because of the irregular zooplankton sampling schedule from 1992 to 1994, the relationship we describe between water levels, zooplankton size structure, and fall fingerling success should be interpreted with caution. Earlier work on rainbow trout food habits showed that zooplankton is only a small component of trout diets in most lakes from May to October (Jarcik and Dillon 1991; 1994), but may be more important in winter. Zooplankton size structure varied seasonally (May to October) and interannually within waters (Appendix G), but our sampling was not initially designed to track that variability in each location. Consequently, we cannot recommend the best timing of zooplankton sampling to predict fall fingerling stocking success. Zooplankton size structure and abundance at the time of stocking should be the best predictor of success, but that short a time frame is unrealistic. Managers would be unable to make stocking decisions until the fish are about to be planted.

A better approach would be to describe zooplankton size structure versus water levels in individual lakes. If this relationship is consistent, water level or drawdown regime could be used as a surrogate for zooplankton data. We could then prescribe minimum fall water levels for successful fall fingerling plants. Stocking strategies would have to be adjusted annually based on the expectation of success or failure of the plant. This will require more zooplankton sampling and stocking evaluation data than are currently available. Zooplankton should be sampled at least in May, July, and September in conjunction with any stocking evaluation until we can better define relationships with water levels and stocking success. If these relationships are consistent across lakes and over time, fall fingerling management decisions could be made with some confidence based on cumulative statewide data.

With the current data, we could not statistically relate spring fingerling or catchable returns to lake characteristics, zooplankton size structure, or angling effort. Some trends were evident for spring fingerlings, however. In general, waters with simple fish communities (one or two species other than trout, e.g. Little Wood, Winchester) had higher spring fingerling returns than those with more complex communities. Lakes with abundant potential predators or competitors (Mann, Spring Valley, Elk Creek, Cascade) had the poorest returns. This is consistent with the literature which suggest returns decline as community complexity increases (Avery 1975; Fraser 1978; Dufek et al. 1980; Ontario Ministry of Natural Resources 1982). Cooper (1959) concluded the best returns of planted trout are likely to occur when little or no competition exists.

Winchester Lake contains largemouth bass *Micropterus salmoides,* a potential predator. They comprised only 1.2% of the 1993 harvest, however, at an average size of 330 mm (Schriever and Cochnauer 1994). Largemouth bass probably prey heavily on fingerling trout, but could not consume all of the 30,000 spring fingerlings planted in 1993. In Spring Valley Reservoir, both largemouth bass and bluegill *Lepomis macrochirus* are present. Prior to 1989, bluegill were absent, largemouth bass proportional stock density (PSD) was low, and spring fingerlings provided a significant part of the fishery (Ed Schriever, IDFG, personal communication). Bluegill were introduced as a forage fish in 1989. From 1989 to 1993, bass PSD increased, and small bluegill have become very abundant, representing both potential predators and competitors. Spring fingerling stocking success declined concurrently.

Magic Reservoir has a simple fish community with no predators and low abundance of competitors, but spring fingerlings stocked in 1993 did not meet return goals. They comprised about 10% of the 1994 trout harvest with a 54% weight return. Had the reservoir not been drained by late summer of 1994, however, spring fingerlings probably would have met the return goal.

Although community complexity seems to influence spring fingerling success, the actual mechanism is unclear. Competition for zooplankton or macroinvertebrate forage appears likely (Fraser 1978; Havens and Sonnichsen 1992). In our study, zooplankton size distribution tended to be larger where return goals were met, but this was not the case in all lakes. More complete and standardized zooplankton data on some waters could help clarify this relationship.

Catchable returns also varied independently of other data, including effort and water level. Variation within lakes among years was high, as was variation within years among lakes. Some of the lowest returns could be explained by severe drawdown (e.g. Chesterfield 1992, Magic 1994) or bird predation (e.g. Springfield 1993, 1994; IDFG unpublished data). All three waters with effort > 750 h/hectare exceeded return goals, but this level of effort is rare in Idaho lakes and reservoirs. Below 750 h/hectare effort, return goals were met in 8 of 25 cases.

Although the data collected to this point is not definitive for developing statewide guidelines for fingerling stocking programs, we can draw some general conclusions. Spring fingerlings were not successful in any water where competitors and predators were abundant. Fall fingerlings, because they are larger, are probably less susceptible to predation in the waters we evaluated. Success of fall fingerlings appears to be closely tied to fall water levels and availability of large zooplankton, but these relationships are not conclusive. Additional stocking evaluations and concurrent limnology and zooplankton data are needed to strengthen or clarify the trend data we have at this point. We may never have enough evaluation data to statistically analyze the various factors affecting returns. Ongoing development and interpretation of this database will, however, provide a statewide perspective not possible with regional or site-specific data.

Trophy Trout Evaluations

The reduction in stocking densities in Daniels and 24-Mile since 1992 has improved size structure and condition of fish. The improved size structure (%>406 mm) is not related (mathematically) to decreased stocking; i.e. the percentages were not merely skewed upward

since 1992 because fewer small fish were stocked and available for sampling. Better growth of 1993 plants than 1992 plants (Appendices D-1, D-2) could explain the shift in size structure. Both waters exceed the management goal by a considerable margin, although few legal fish are harvested.

Current stocking rate (30 spring catchables + 100 fall fingerlings per hectare) on both these trophy waters is about half the rate stocked in nearby yield fisheries. For fall fingerlings it is also on the low end of the recommended range of stocking rates for highly productive trout-only waters (Dillon and Megargle 1994). Stocking rates for other trophy waters should also be developed based on this approach. For example, in a low productivity trout-only lake, the recommended stocking rate for a yield fishery is 50-100 fall fingerlings per hectare (Dillon and Megargle 1994). Under trophy regulations, where multiple year classes may be present due to length limits, stocking rate should be reduced to about 25-50 fish/hectare. Such stocking rates should serve to minimize intraspecific competition and maintain growth.

Our 1994 population estimates suggest a decrease in fish densities and standing crop since 1993. Fish condition data support that this likely occurred, but the 1994 population estimates have some important limitations. Recapture rates were low for all the Peterson estimates, and no estimates were possible for 1992 or 1993 catchables, cutthroat, or hybrids. The one-sample method provided estimates with relatively tight confidence limits. The recapture rate (capture probability) for newly-stocked fish was higher than for most other groups, however. This indicates the one-sample method probably underestimated abundance of all groups except 1993 fall fingerlings. In 1993 population estimates, recapture rates were similar for all groups including the newly-stocked fish. Based on these concerns, we feel the 1994 estimates are of questionable accuracy. More intensive sampling with less selective gear (e.g. trap nets, purse seine) will be necessary to obtain reliable estimates of population density and survival.

Although our survival estimates contain some unquantified error, clearly the survival of both fingerlings and catchables planted in Daniels in 1992 and 1993 was poor. Catchables comprised only a small portion of the 1992- and 1993-stocked fish surviving to spring of 1994. This could be attributed to a combination of natural and catch-and-release hooking mortality. By our estimates, hooking mortality could essentially exploit 13% to 26% of the fish population in a given year. Whatever the cause, the poor survival does not prevent the Daniels Reservoir fishery from meeting the management goal for size structure, and catch rates remain high. Such survival rates may explain why so few fish in Daniels and 24-Mile attain legal size, however. Development of high quality survival estimates and their subsequent use in population simulations would help us understand the mechanisms limiting size structure in Daniels and other trophy fisheries.

In addition to annual stocking, natural recruitment is also contributing to fish populations in Daniels. We documented at least two year classes of natural recruits in the reservoir (up to 18% of our total reservoir samples), and found naturally produced juveniles in Malad Spring Creek. It may be important to quantify natural recruitment to the reservoir. Reduction in stocking rates has increased the average size and condition of fish in the population, but this could be negated if natural recruitment continues. To maintain the quality of the fishery, we may need to further reduce or eliminate stocking in the future.

Statewide, IDFG manages nine lakes or reservoirs for trophy trout, but to date we have detailed information on only the above two waters. We do not know whether the other seven trophy waters are meeting the management goal. At least five of these could be classified as alpine lakes and are probably much less productive and colder than Daniels and 24-Mile. As IDFG increases emphasis on trophy management (1991-1995 Fisheries Management Plan; IDFG 1990) it seems important to develop a broader perspective of appropriate lake types and stocking rates that can produce and maintain such fisheries. We should collect information on stocking rates, population size structure, and lake characteristics on as many other existing trophy trout waters as possible. This would allow us to verify or improve our stocking rate guidelines for existing or new trophy waters, which are currently based on relatively little data.

CONCLUSIONS

The variability in water years from 1992-1994 has made it difficult to develop statewide stocking guidelines for spring and fall fingerlings and catchables with our current data. We should continue to build on the database, with emphasis on stocking evaluations for at least five additional waters in 1995. May, July, and September sampling for zooplankton size structure and abundance should be standardized and carried out in conjunction with all fingerling/catchable evaluations. In addition, we should include standard lowland lake surveys on waters with stocking evaluations, and incorporate relative abundance of predators and competitors into future analyses.

Though conclusions are tentative, the success of fall fingerling plants appears to be related to severity of drawdown and zooplankton size structure. In cases with extreme drawdown and no zooplankton >2.0 mm, fall fingerling plants failed to meet return goals. Unless limited by predation, reservoir draining, or other unique events, fall fingerlings should meet return goals when zooplankton >2.0 mm are available the year of stocking.

Spring fingerlings are unlikely to provide acceptable returns in waters with complex communities (more than two potential competitors or predators). We should continue to evaluate the relationship between zooplankton size structure and spring fingerling stocking success.

Catchable returns were highly variable, and unrelated to angling effort or water levels.

The variation in water levels and return rates has not provided consistent results on which to judge the relative costs to the creel of spring and fall fingerlings and catchables.

Reduced stocking rates since 1992 have improved condition and size structure of the trout populations in Daniels and 24-Mile reservoirs while maintaining acceptable catch rates. Populations in both exceed the goal in the management plan for trophy fisheries. In Daniels, fall fingerling plants survived better and contributed more to the population than catchable plants. Based on our survival estimates, catchable stocking could be discontinued with minimal impact on population abundance. Stocking rates in trophy waters should be no more than half the recommended rate for general regulation yield fisheries. If natural recruitment continues or increases in Daniels, we should adjust stocking to maintain current densities of fish.

Although the Daniels fishery meets management goals, catch-and-release fishing could be an important source of mortality, and may limit size structure in the population. The importance of hooking mortality will be dependent on "natural mortality" of planted trout. Our survival estimates are poor and also contain imprecise measures of hooking mortality. Hooking mortality may be more important in waters with slower trout growth, better survival, or more intense angling pressure. Comprehensive assessments of hooking mortality and its effect on population size structure will require more accurate estimates of population size and "natural mortality" rates.

RECOMMENDATIONS

1. Unless evaluations demonstrate acceptable returns, discontinue fall fingerling plants in reservoirs in years with extreme drawdown, and in any water where zooplankton >2.0 mm are not available the year of planting.

2. Unless evaluations show acceptable returns, do not use spring fingerlings where more than two potentially competing or predatory species exist.

3. Monitor or quantify natural recruitment in Daniels Reservoir. Adjust stocking to maintain current densities of fish.

4. Continue building on the fingerling/catchable evaluation data base; include at least five new waters in 1995, and emphasize monthly (May through Oct) samples of zooplankton size structure in conjunction with stocking evaluations.

5. Include standardized lowland lake surveys as part of stocking evaluations; incorporate relative abundance data for predators and competitors into future analyses.

6. Compile or collect data on stocking rates, population size structure, lake characteristics, and angling effort in other trophy waters. Modify trophy lake criteria and stocking rate guidelines as data become available.

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APPENDICES

Appendix A. Costs to rear and stock catchable rainbow trout at IDFG hatcheries, 1992 (IDFG unpublished data).

Hatchery	Number of fish	Cost($)	Cost per fish
Hagerman	950,575	182,097	0.19
American Falls	110,600	33,139	0.29
Grace	100,050	.35,749	0.36
Nampa	226,100	109,397	0.48
Hayspur	142,250	79,475	0.56
Clearwater	152,500	116,643	0.76
McCall	35,048	29,896	0.85
Mullan	54,050	47,086	0.87
Mackay	105,900	127,662	1.20
Ashton	58,800	78,488	1.33
ClarkFork	149.900	289.979	1.93
	2,085,773	1,129,656	0.54

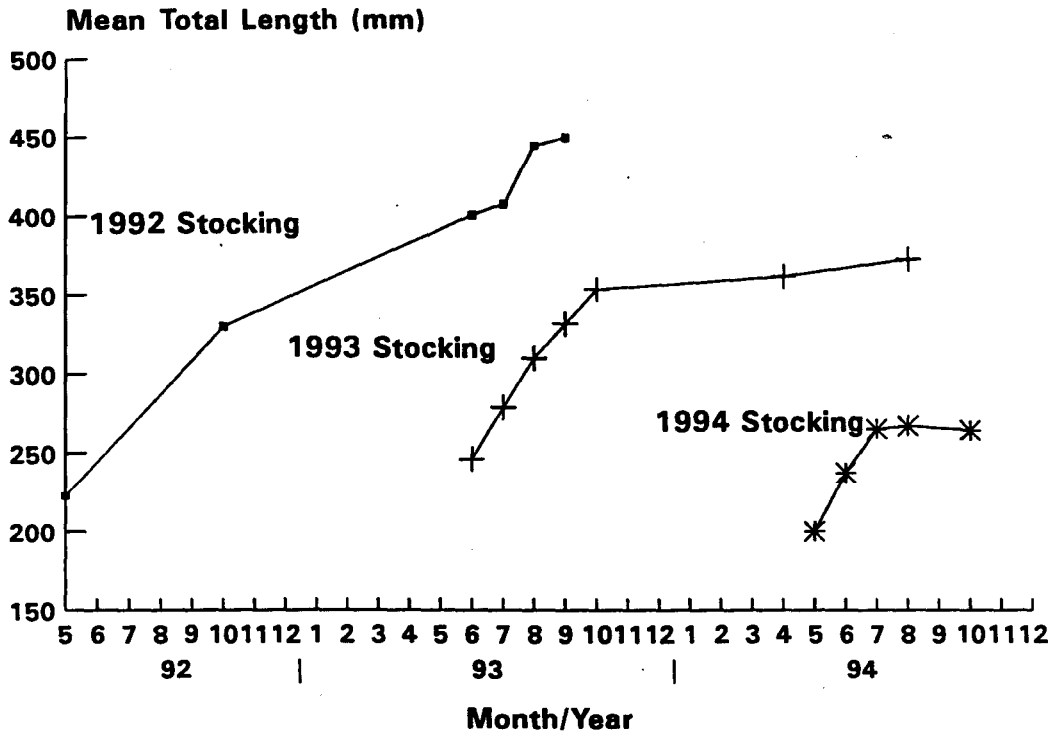
Appendix B. Creel census effort summaries for Idaho waters with fingerling-catchable stocking evaluations, 1991-1994.

Location	Year	Total effort (hrs)	Hours/hectare
Spirit Lake	1992	31,337	54
Hauser Lake	1993	35,392	240
Spring Valley Reservoir	1993	35,226	1,610
Mann Lake	1993	30,994	766
Winchester Lake	1993	43,030	1,418
Soldiers Meadow Reservoir	1993	14,973	366
Cascade Reservoir	1991-1992	206,465	17
C.J. Strike Reservoir	1991	238,248	78
Magic Reservoir	1992	60,716	300
	1993	52,242	71
	1994	71,656	358
Little Wood Reservoir	1992	14,929	250
	1993	18,074	89
	1994	26,601	443
Springfield Lake	1992	3,444	129
	1993	16,900	633
Daniels Reservoir	1993	41,173	271
	1994	27,229	180
Twin Lakes	1992	13,639	84
	1993	39,312	218
	1994	38,289	211
Winder Reservoir	1992	13,295	547
	1993	11,056	291
	1994	17,317	577
Treasureton Reservoir	1992	11,085	350
	1993	23,896	412
	1994	7,939	176
Chesterfield Reservoir	1992	5,903	35
	1993	28,589	44
	1994	150,151	359
24-Mile Reservoir	1993	7,627	380
	1994	4,571	229
Ririe Reservoir	1993	0	0

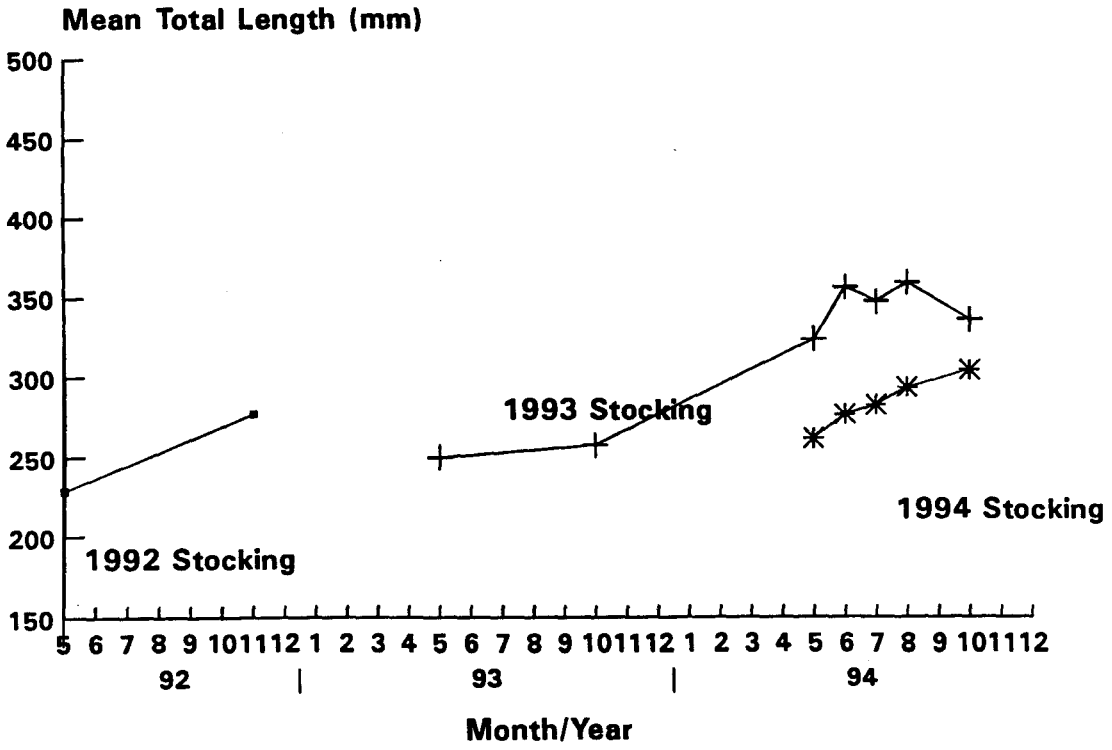
Appendix C. Estimated cost per fish in the creel for spring fingerling, fall fingerling, and catchable rainbow trout in 16 Idaho lakes and reservoirs, 1991-1994. Estimates are based on stocking costs of $0.05, $0.12, and $0.54 per fish, respectively.

		Cost ($) per fish in the creel		
Location	Year	Spring fingerling	Fall fingerling	Catchable
Magic Reservoir	1992	1.32	120.00	1.90
	1993	4.55	2.00	1.62
	1994	-	-	8.71
LittleWood Reservoir	1992	0.60	40.00	1.42
	1993	0.35	1.21	0.68
	1994	-	-	0.87
Winder Reservoir	1992	-	12.00	0.77
	1993	-	1.71	1.86
	1994	-	-	1.54
Twin Lakes	1992	-	1.03	1.46
	1993	-	0.46	2.57
	1994	-	-	2.08
Treasureton Reservoir	1992	-	-	1.50
	1993	-	-	0.68
Chesterfield Reservoir	1992	-	-	15.00
	1993	-	0.34	1.59
	1994	-	-	1.32
Springfield Lake	1992	-	0.80	6.07
	1993	-	2.55	540.00
	1994	-		> 500.00
Spirit Lake	1993	2.27	-	8.44
Hauser Lake	1993		2.00	0.70
Spring Valley Reservoir	1993	1.72	20.00	1.00
Mann Lake	1993	3.13	-	0.95
Winchester Lake	1993	0.10	3.33	0.90
Soldiers Meadow Reservoir	1993	0.54	-	0.68
Cascade Reservoir	1991-92	6.67	85.71	2.45
C.J. Strike Reservoir	1992	0.22	-	-
Ririe Reservoir	1993		4.29	0.99

Magic Res.

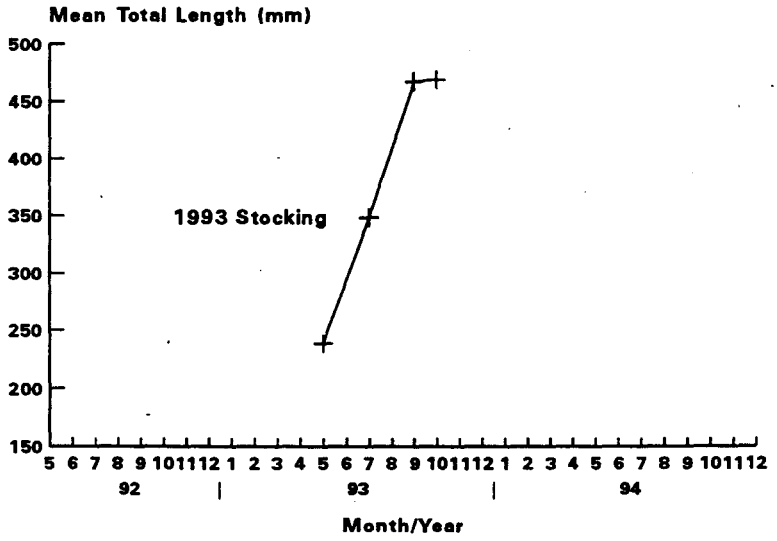


Little Wood Res.

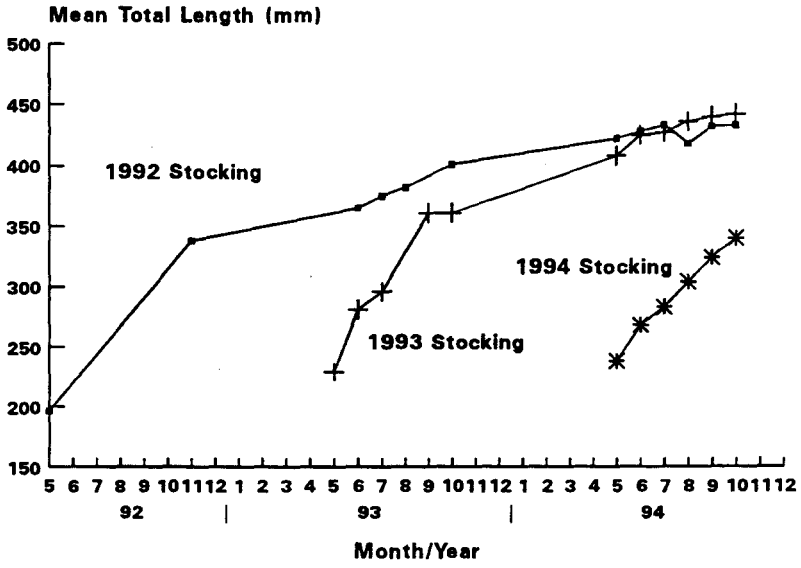


Appendix D-1. Growth of catchable rainbow trout in nine Idaho reservoirs.

Springfield Lake

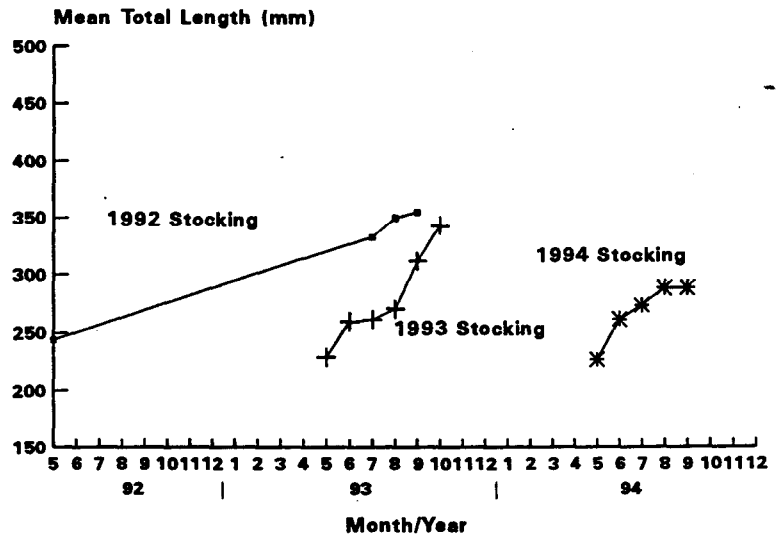


Daniels Res.

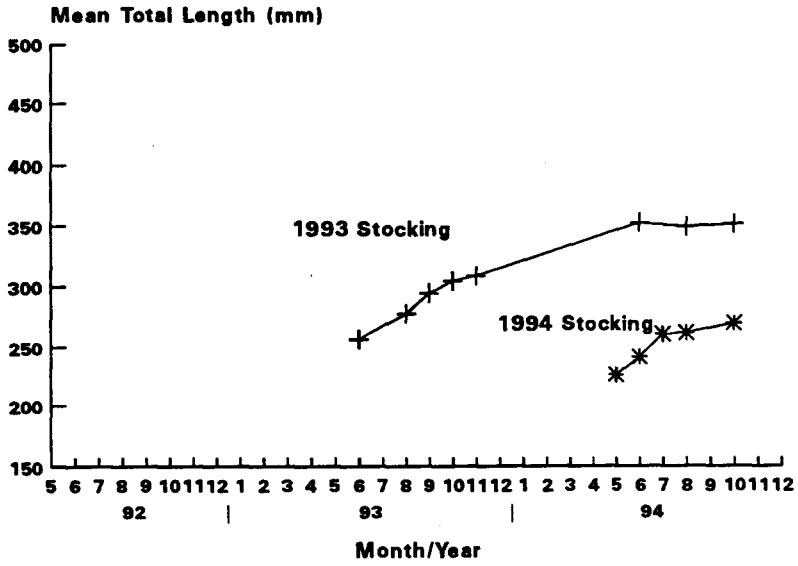


Appendix D-1. continued

Twin Lakes

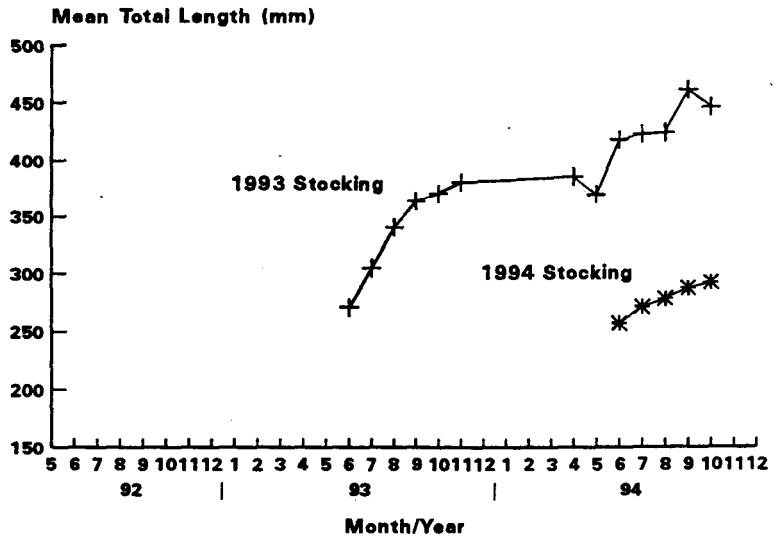


Winder Res.

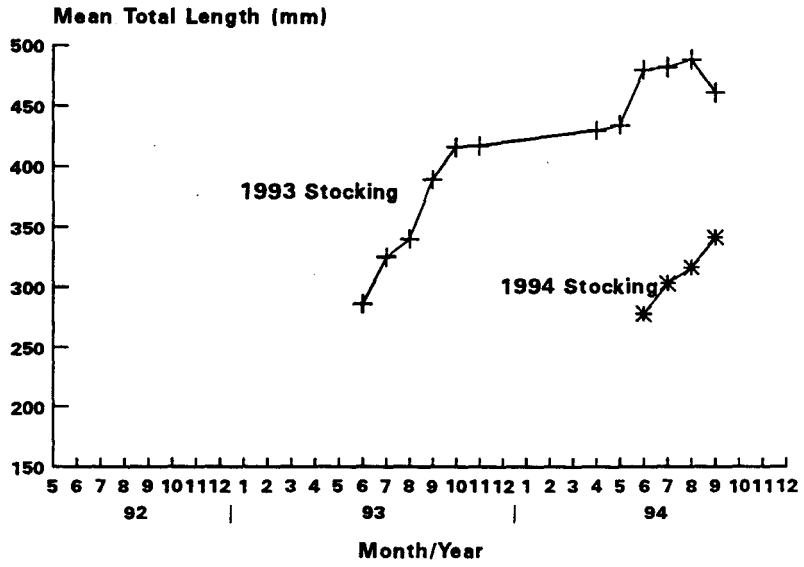


Appendix D-1. continued

Treasureton Res.

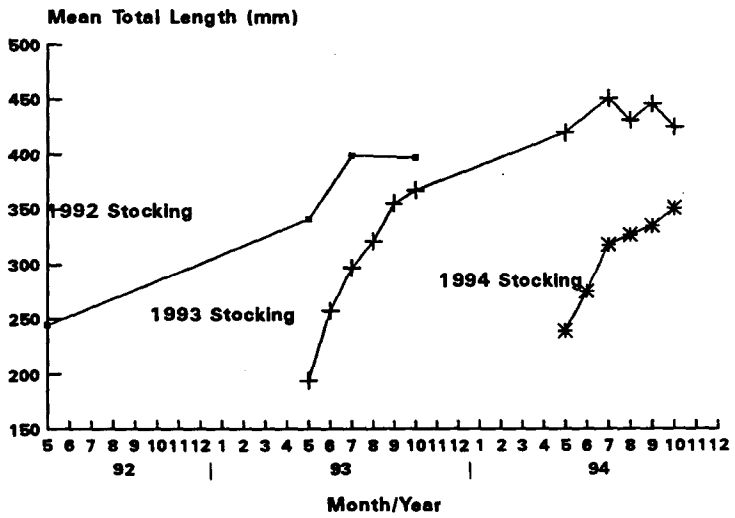


Chesterfield Res.



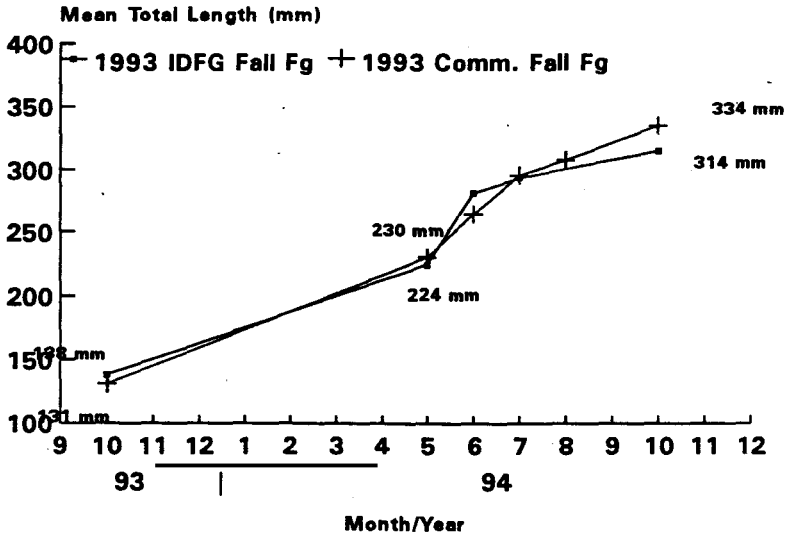
Appendix D-1. continued

24-Mile Res.

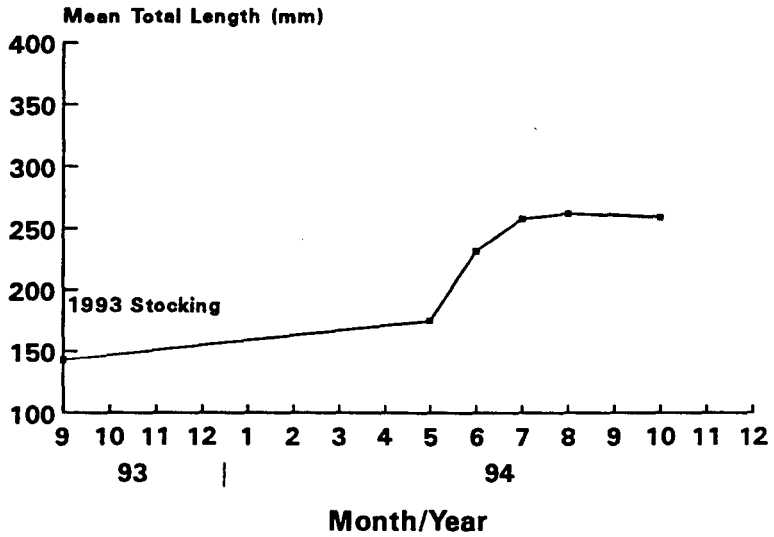


Appendix D-1. continued

Magic Res.

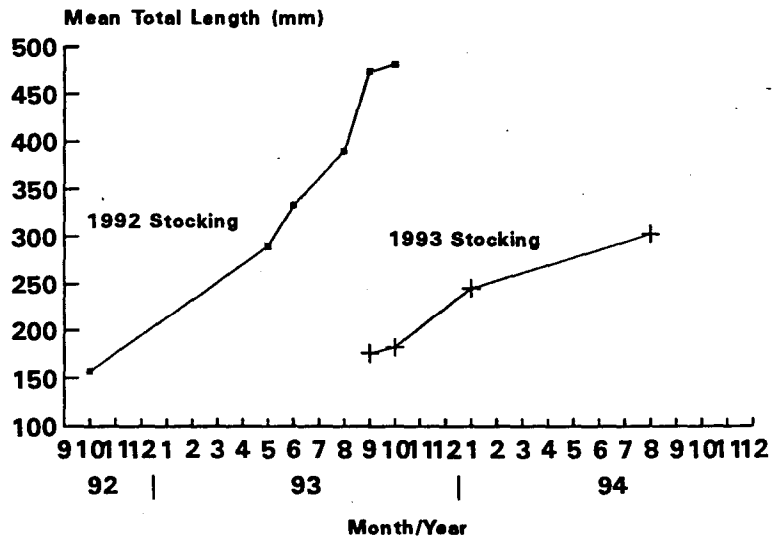


Little Wood Res.

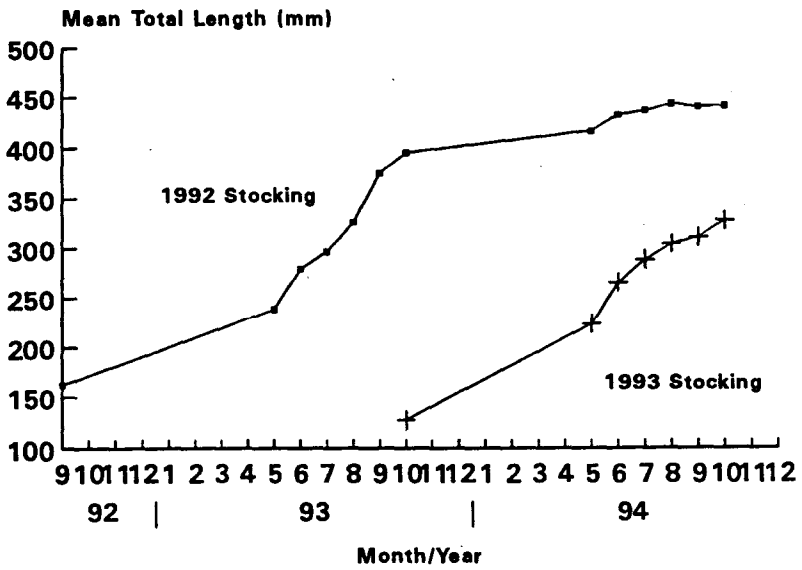


Appendix D-2. Growth of fall fingerling rainbow trout in nine Idaho reservoirs, 1992 to 1994.

Springfield Lake

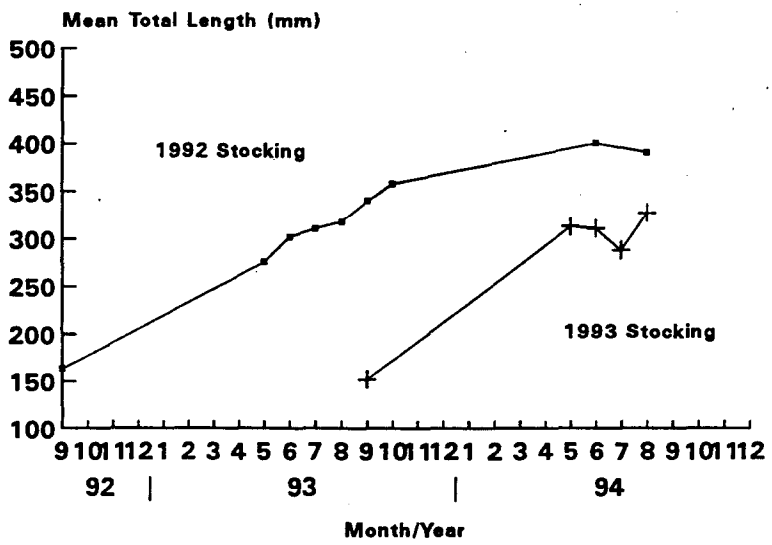


Daniels Res.

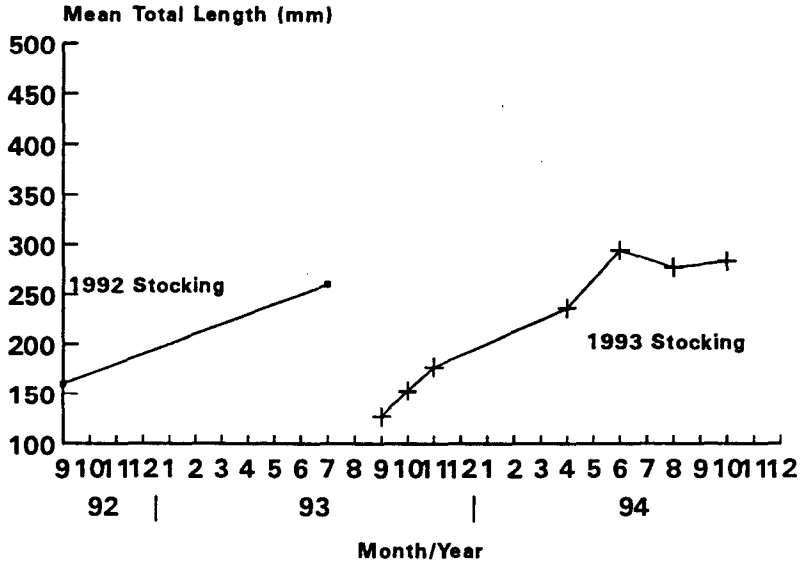


Appendix D-2. continued

Twin Lakes

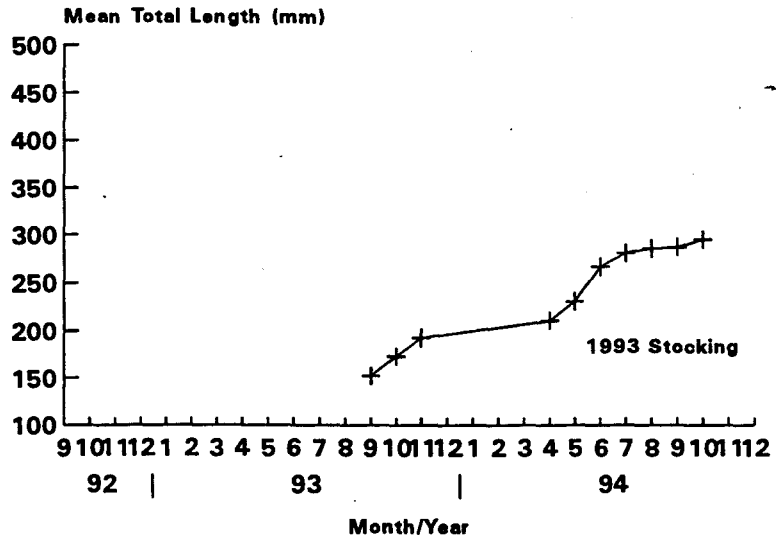


Winder Res.

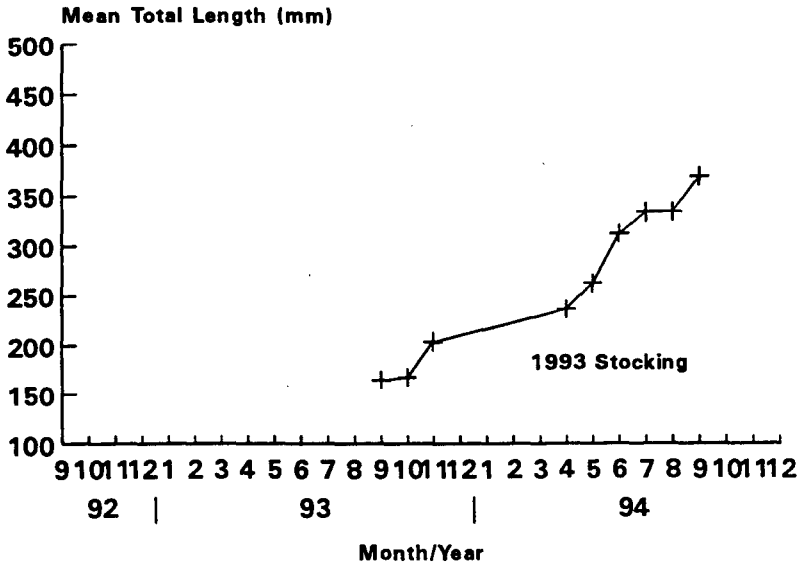


Appendix D-2. continued

Treasureton Res.

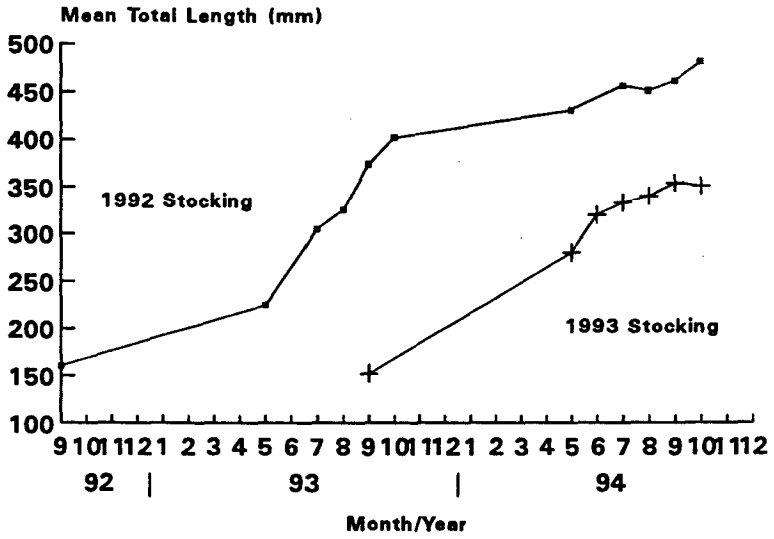


Chesterfield Res.



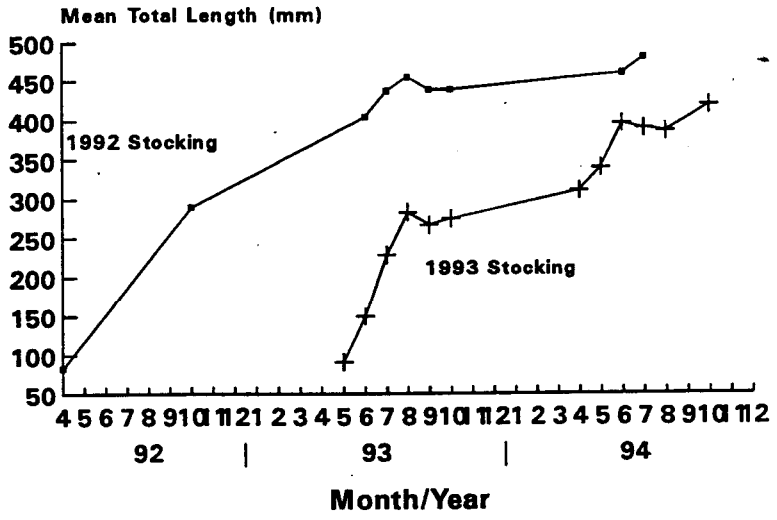
Appendix D-2. continued

24-Mile Res.

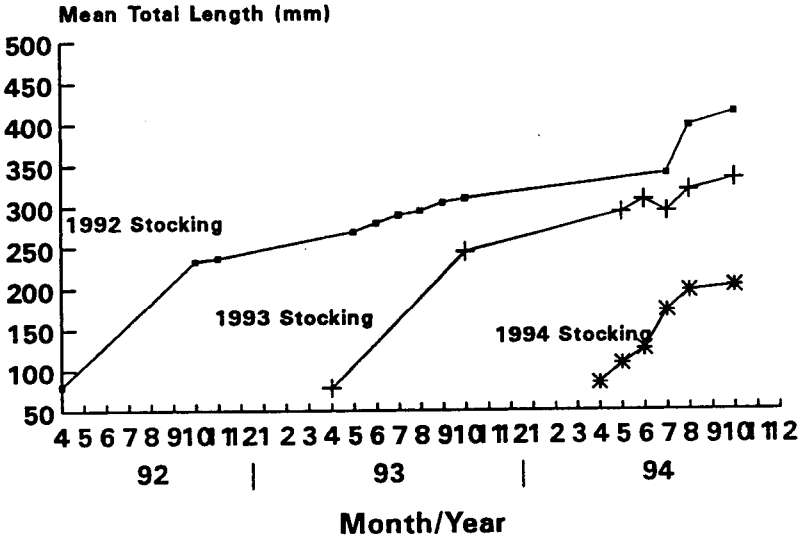


Appendix D-2. continued

Magic Res.



Little Wood Res.



Appendix D-3. Growth of spring fingerling rainbow trout in Magic and Little Wood reservoirs, 1992 to 1994.

Appendix E. Mean monthly relative weight (all size classes combined) for rainbow trout in eight Idaho reservoirs, 1994.

	MeanRelativeWeight					
	May	Jun	Jul	Aug	Sep	Oct
Magic Reservoir	103	106	93	94		83
LittleWood Reservoir	94-	92	93	83		81
Daniels Reservoir	112	101	98	100	92	94
24-Mile Reservoir	117	107	104	99	93	102
TwinLakes	103	96	96	90	87	
Chesterfield Reservoir	115	111	106	101	100	
Winder Reservoir		87	87		88	67
Treasureton Reservoir	116	103	97	92	86	98

Appendix F. Limnological data and fish species composition for Idaho lakes and reservoirs with fingerling-catchable stocking evaluations.

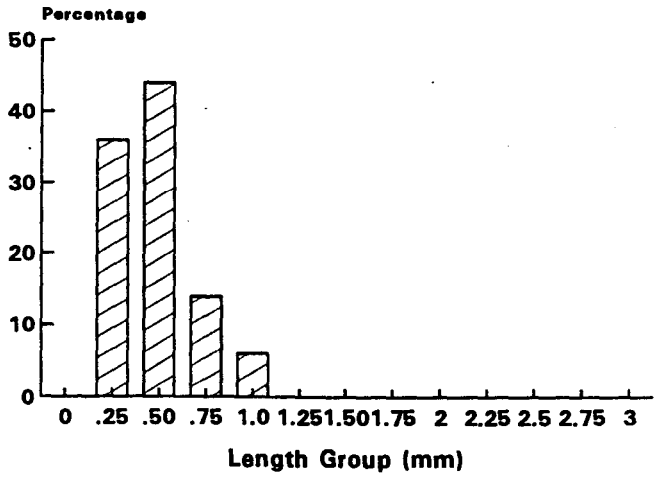
Location	Surface area at full pool (hectares)	Mean depth (m)	Conductivity (mmhos/cm)	Secchi disk transparency (ml)	Total phosphorous (mg/l)	Alkalinity (mg/l)	Total dissolved solids (mg/l)	Species composition'
Spirit Lake	1,700		50	12.7	0.042	25.0	33.0	KOK, LMB, PMS, YEP, NOP, CT, BCR, PWF
Hauser Lake	245	6.0	45	5.2	0.015	19.2	*30.0	PMS, YEP, BCR, BBH, TEN, LMB, TIM
Spring Valley Reservoir	21	4.3	31	2.7			22.8	LMB, BLG
Mann Lake	49	4.7	84	1.8			58.2	LMB, PMS, BCR, SU
Winchester Reservoir	34	3.4	135	1.0	0.062	67.6	90.2	LMB, BBH
Soldiers Meadow Reservoir	41		63	0.8	0.080	27.4	42.0	KOK, BCR
Cascade Reservoir	12,145	17.1	58	2.9	0.050	17.3	38.7	YEP, COH, SMB, SQF, SU, KOK, BBH, MWF
C.J. Strike Reservoir	3,036	2.1	651	1.3	0.042	152.0	434.0	BLG, LMB, SMB, PMS, YEP, BCR, SQF, RSS, SU, CAR, CHS, BBH, CCF
Magic Reservoir	729	32.5	492	2.7	0.022	97.9	328.0	WRB, YEP, SU, RSS
Little Wood Reservoir	238	16.1	295	2.4			196.7	WRB, SU
Springfield Lake	26	1.6	529	2.7			352.7	UTC, SU, BRT
Daniels Reservoir	151	7.0	507	2.6			338.0	LCT, HYB
Twin Lakes	181	9.5	304	3.5			159.8	CAR, BLG, LMB, TIM

Appendix F. (Continued).

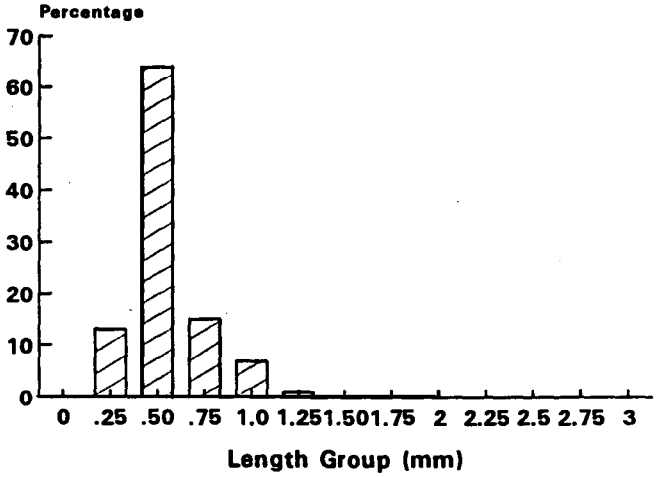
Location	Surface area at full pool (hectares)	Mean depth (m)	Conductivity (mmhos/cm)	Secchi disk transparency Im1	Total phosphorous (mall)	Alkalinity (mall)	Total dissolved solids (mall)	Species Composition[a]
Winder Reservoir	38	5.4	218	4.1		-	145.3	LMB, BLG, YEP, GSF
Treasureton Reservoir	63				0.198	165.0		Hatchery rainbow only
Chesterfield Reservoir	645	4.5	290	1.5	0.045	152.0	193.3	BRT
24-Mile Reservoir	20	3.0	600	6.7			400.0	MTS, LCT, HYB, BKT
Ririe Reservoir	632	19.6	310	7.0	0.015	169.0	207.0	SMB, UTC, SU, RSS

[a] KOK = kokanee; LMB = largemouth bass; PMS = pumpkinseed sunfish; YEP = yellow perch; NOP = northern pike; CT = cutthroat trout; BCR = black crappie; PWF = pygmy whitefish; BBH = brown bullhead; TEN = tench; TIM = tiger musky; BLG = bluegill; SU = sucker species; COH = coho salmon; SMB = smallmouth bass; SOF = northern squawfish; MWF = mountain whitefish; RSS = redside shiner; CAR = carp; CHS = chiselmouth; CCF = channel catfish; WRB = wild rainbow trout; UTC = Utah chub; BRT = brown trout; LCT = Lahontan cutthroat trout; HYB = rainbow x cutthroat hybrids; GSF = green sunfish; MTS = mountain sucker; BKT = brook trout.

Spirit Lake 9/16/92

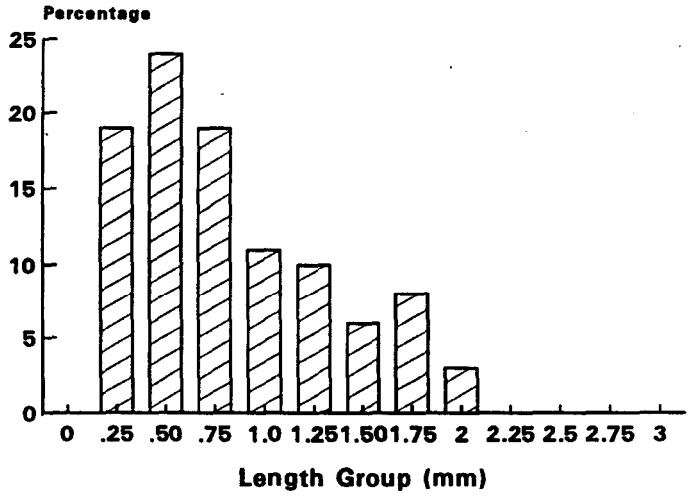


Spirit Lake 8/10/93

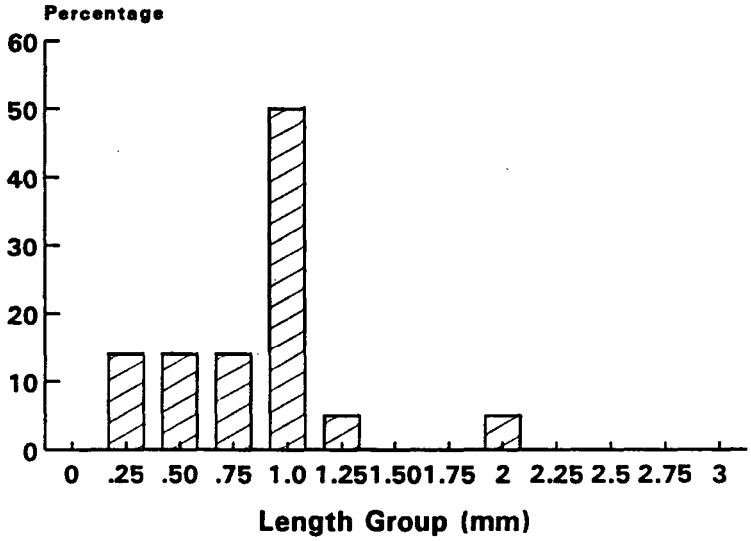


Appendix G. Graphical representations of interannual variations in zooplankton length-frequencies (all general combined) in Idaho lakes and reservoirs with fingerling-catchable stocking evaluations.

Hauser Lake 9/16/92

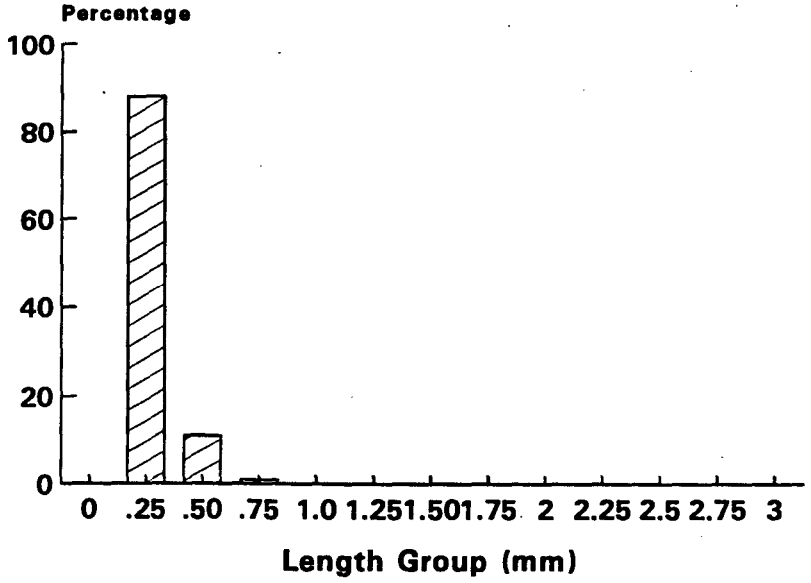


Hauser Lake 8/15/93

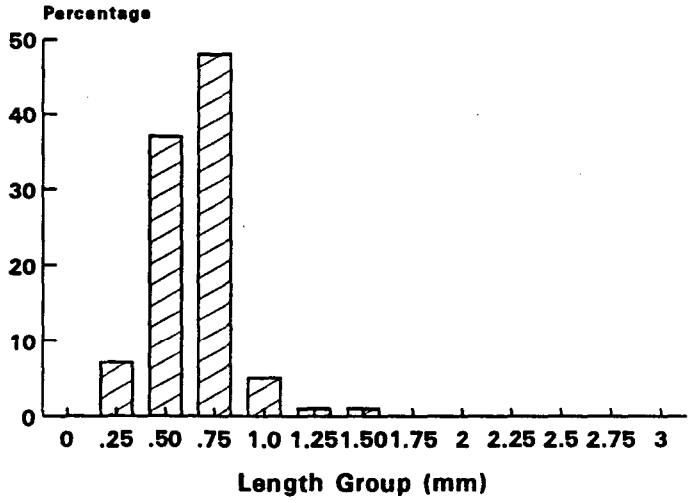


Appendix G. (Continued.)

Mann Lake 9/9/92

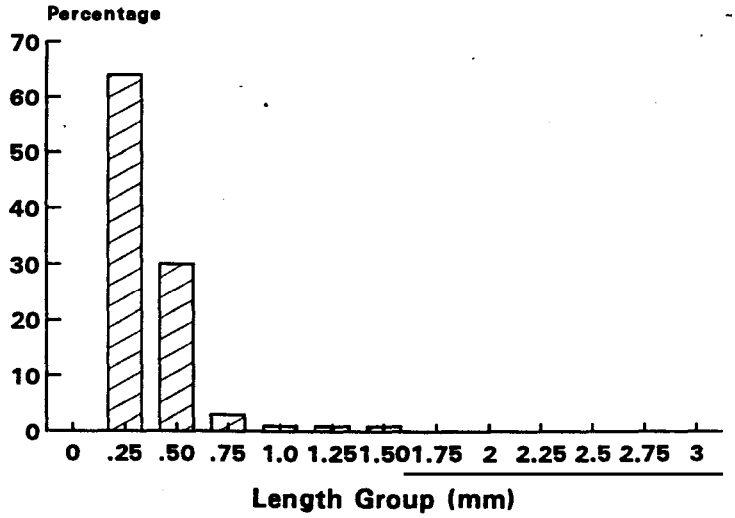


Mann Lake 8/18/93

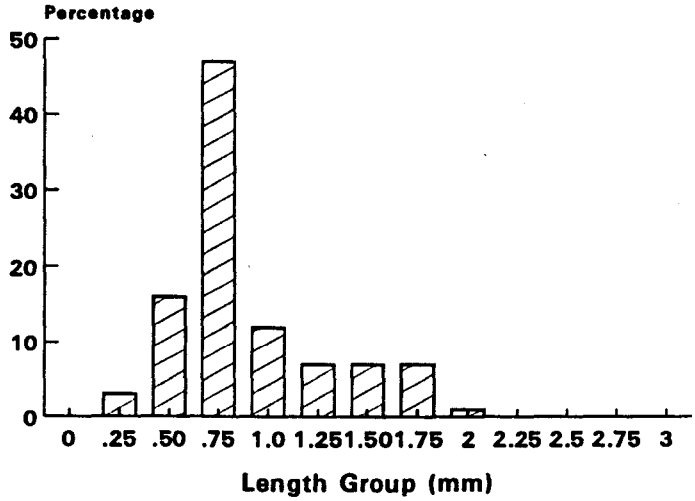


Appendix G. (Continued.)

Winchester Lake 5/22/92

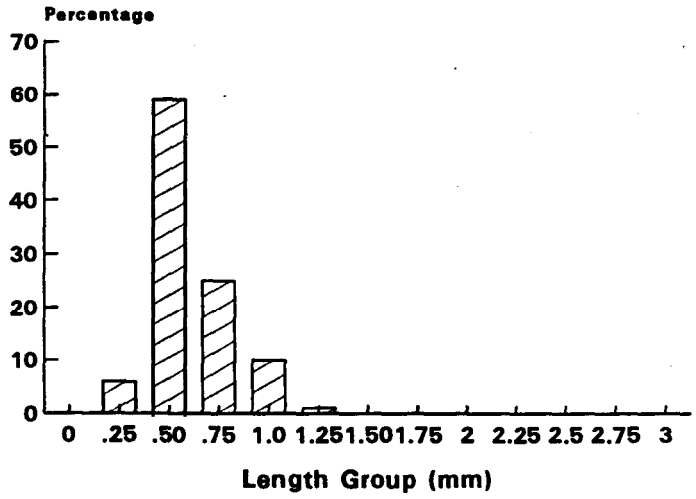


Winchester Lake 6/22/93

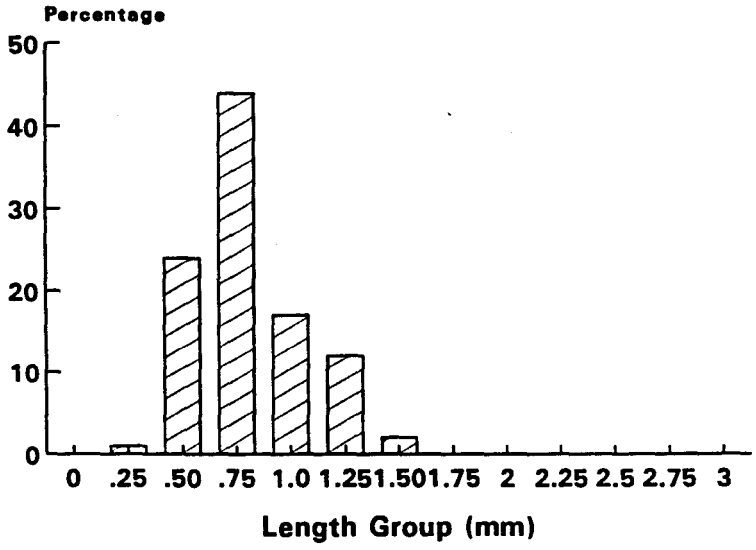


Appendix G. (Continued.)

Soldiers Meadow Res. 9/9/92

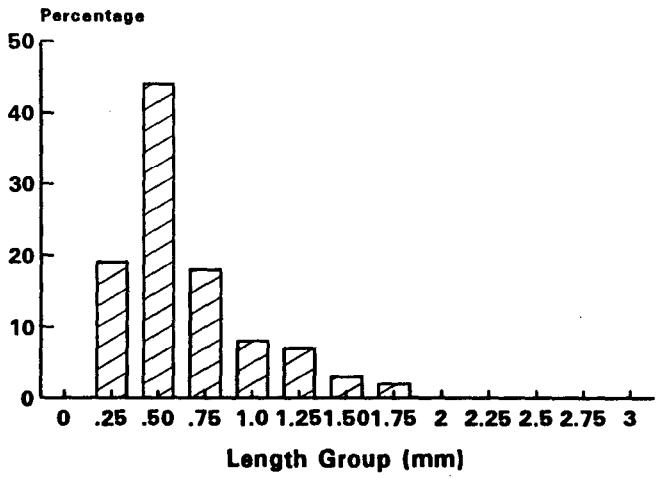


Soldiers Meadow Res. 8/13/93

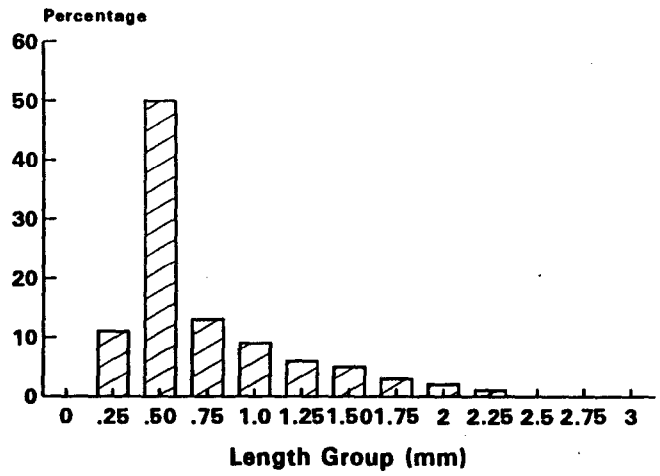


Appendix G. (Continued.)

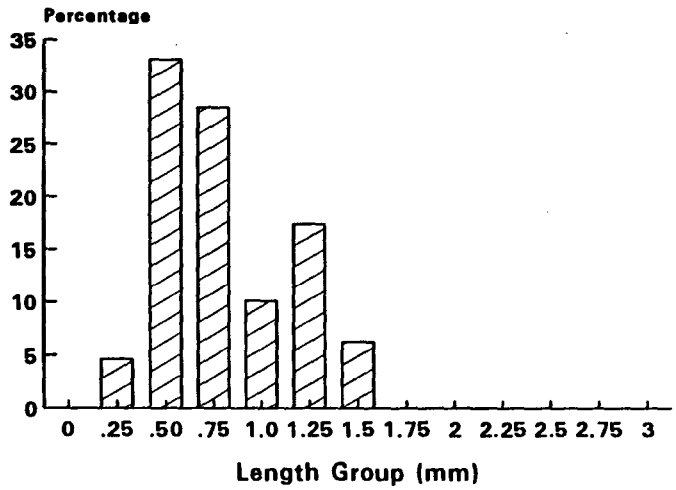
Magic Res. 7/3/92



Magic Res. 7/2/93

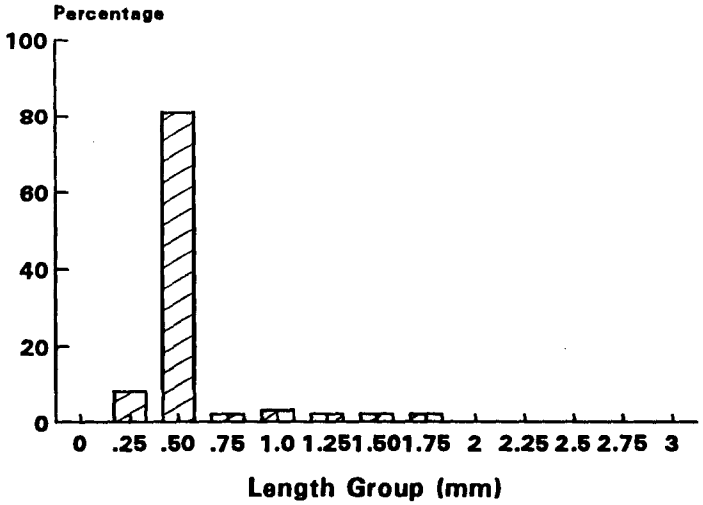


Magic Res. 7/12/94

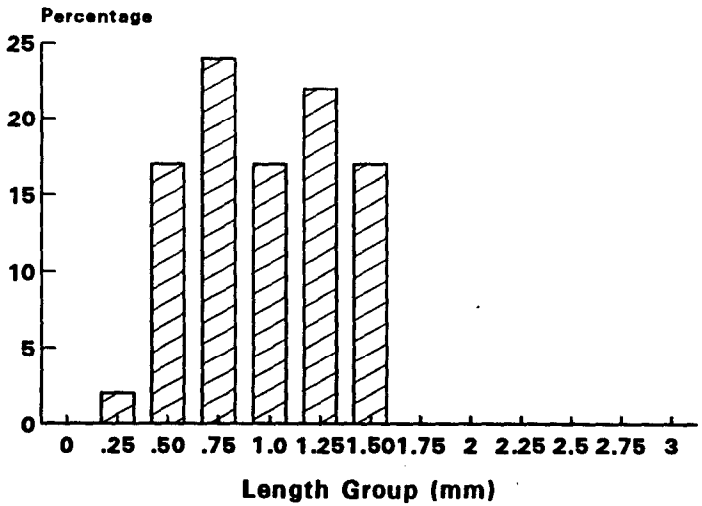


Appendix G. (Continued.)

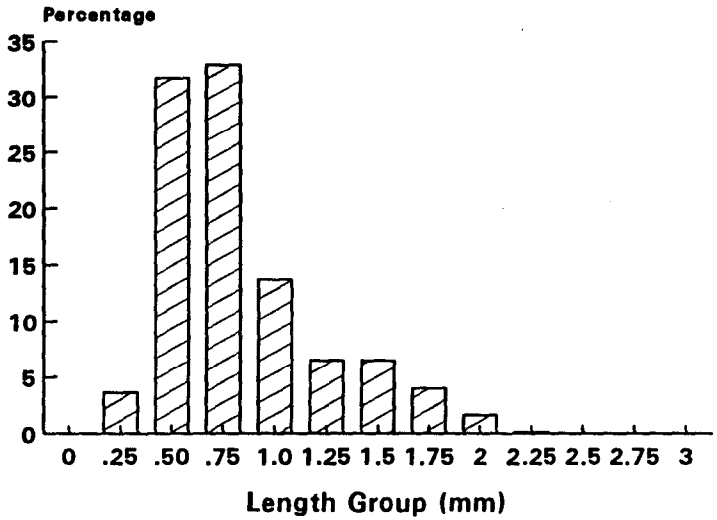
Little Wood Res. 7/4/92



Little Wood Res. 7/2/93

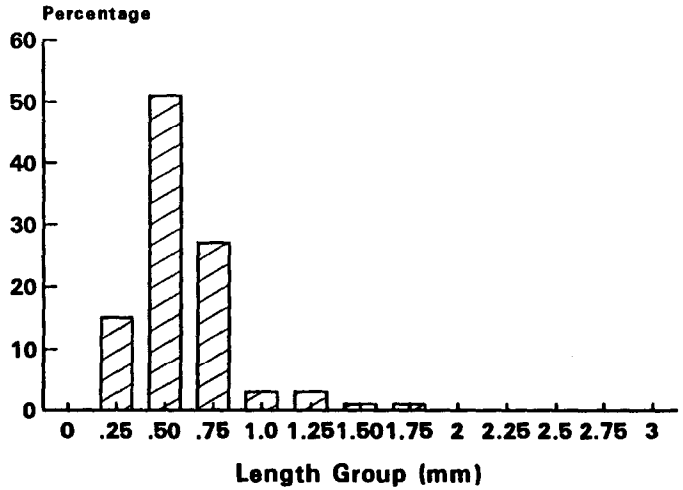


Little Wood Res. 7/11/94

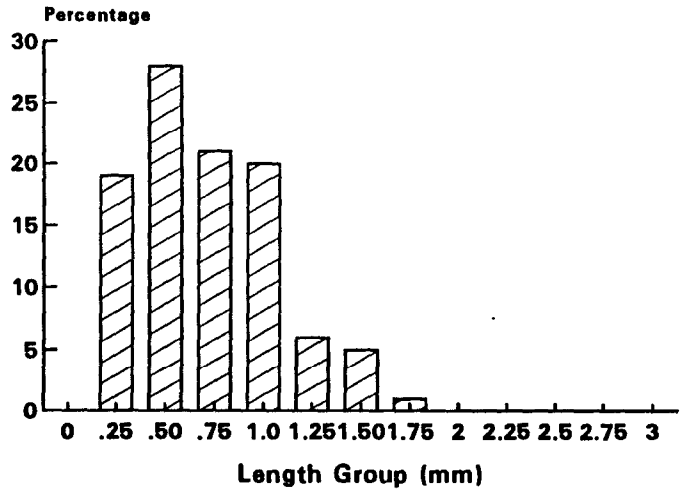


Appendix G. (Continued.)

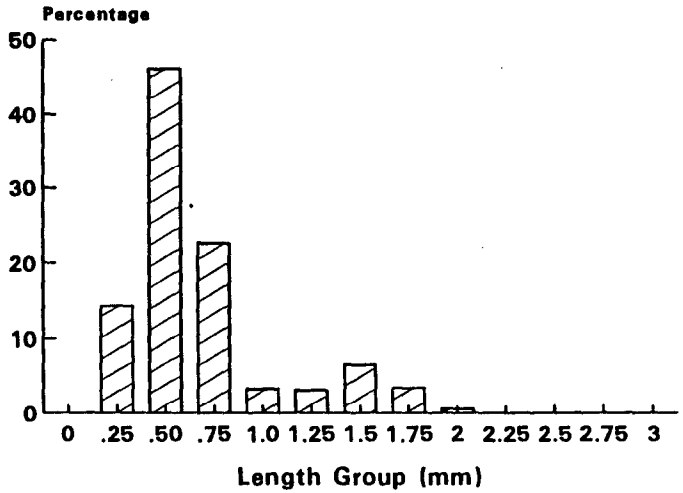
Daniels Res. 6/27/92



Daniels Res. 7/14/93

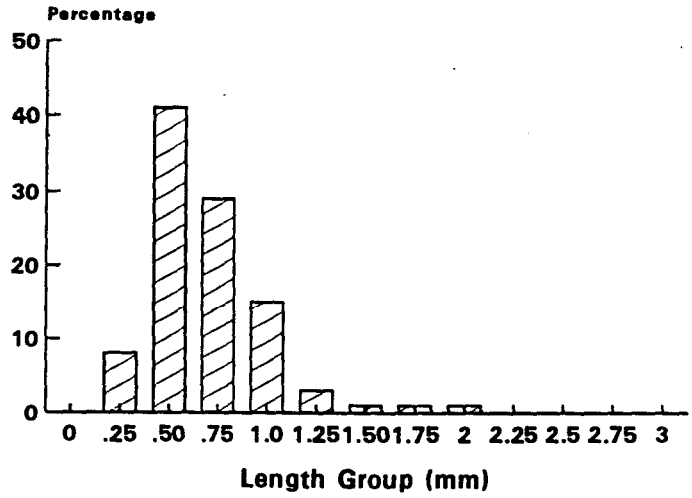


Daniels Res. 7/8/94

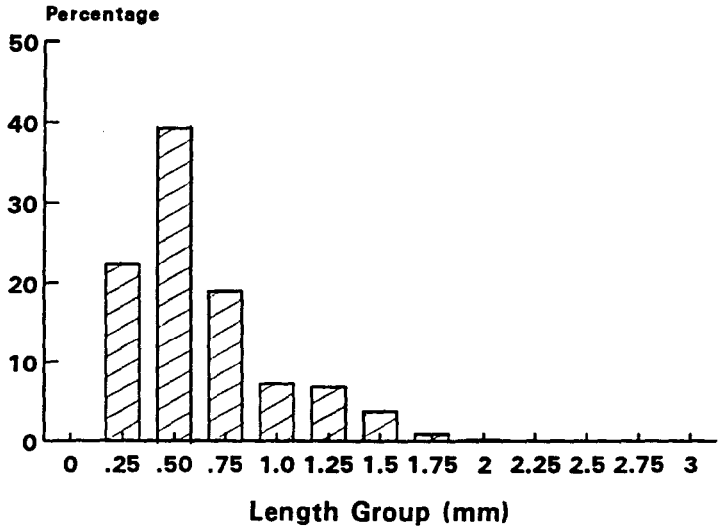


Appendix G. (Continued.)

Twin Lakes 7/16/93

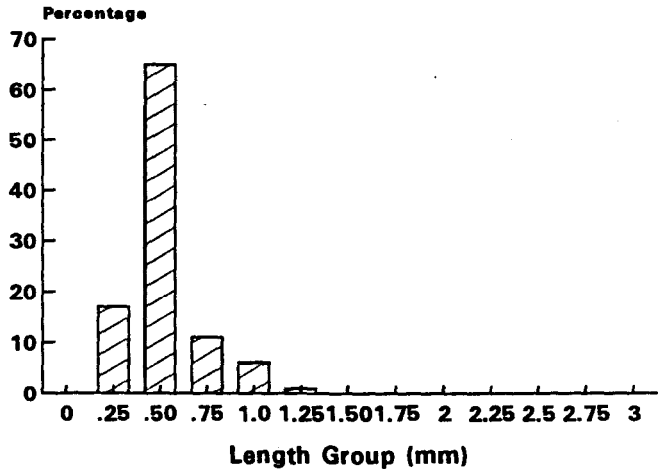


Twin Lakes 7/6/94

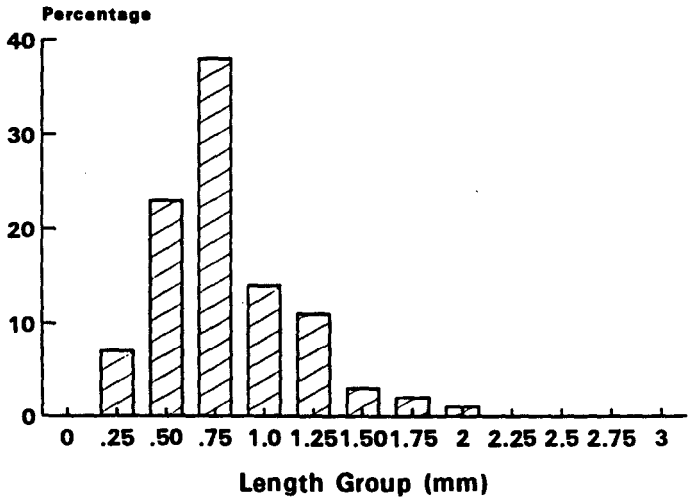


Appendix G. (Continued.)

Winder Res. 6/29/92

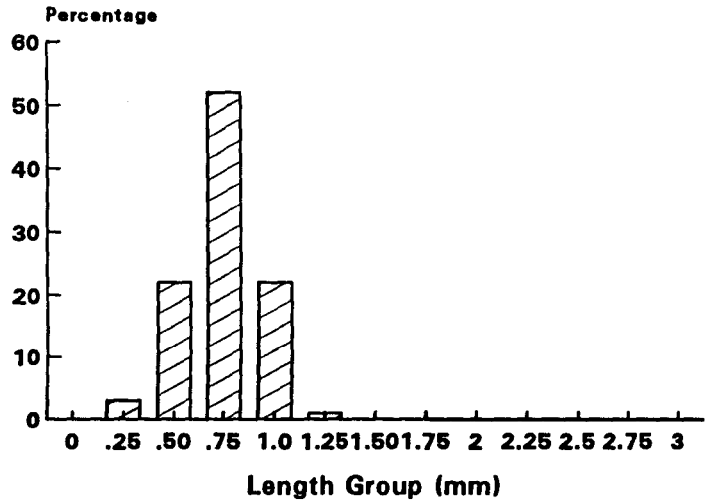


Winder Res. 7/15/93

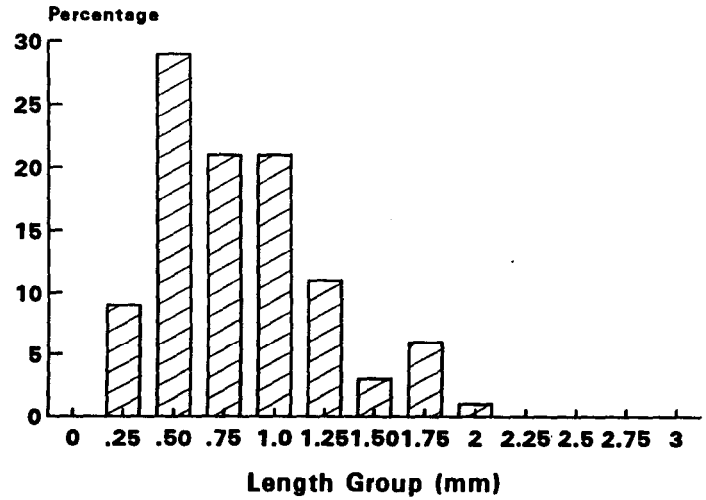


Appendix G. (Continued.)

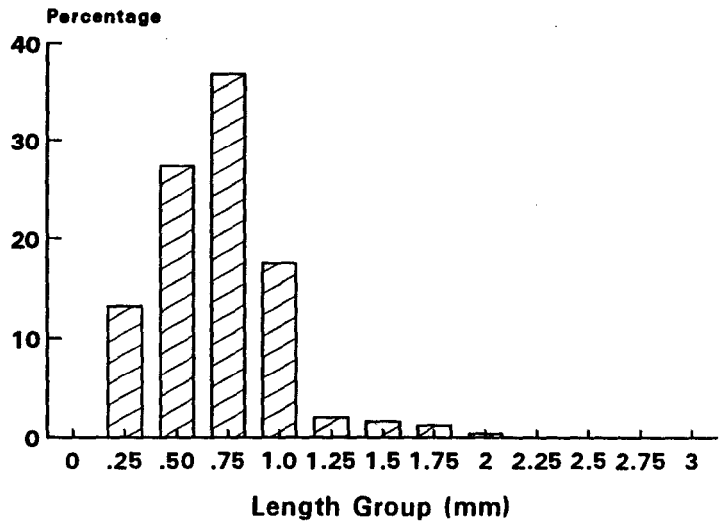
24-Mile Res. 6/26/92



24-Mile Res. 6/30/93

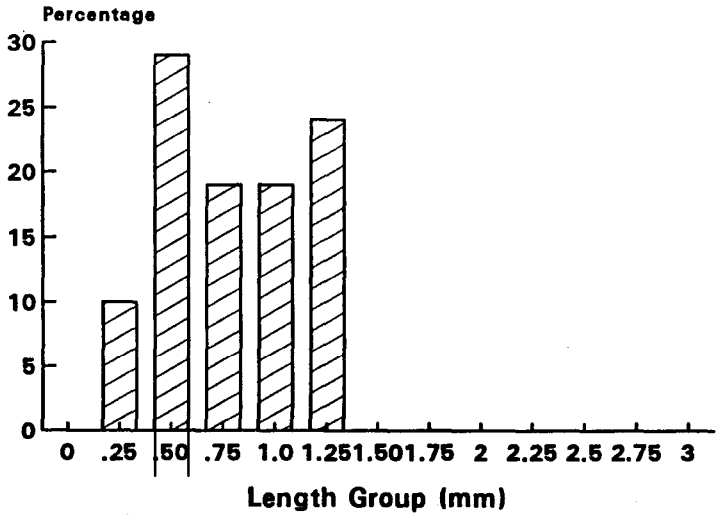


24-Mile Res. 6/21/94

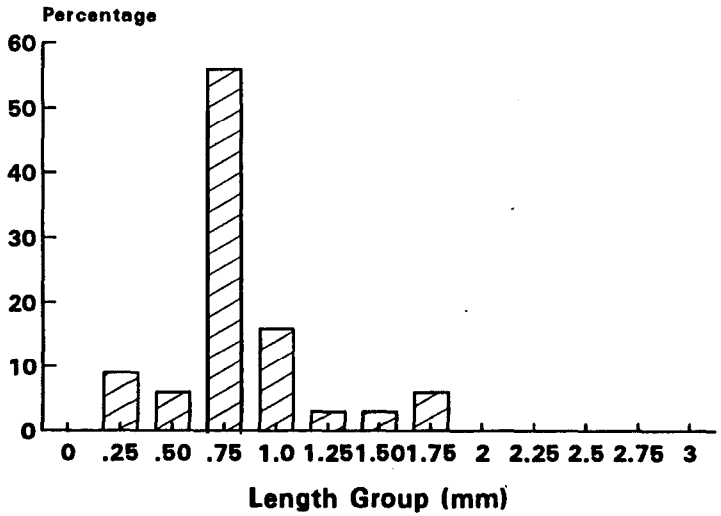


Appendix G. (Continued.)

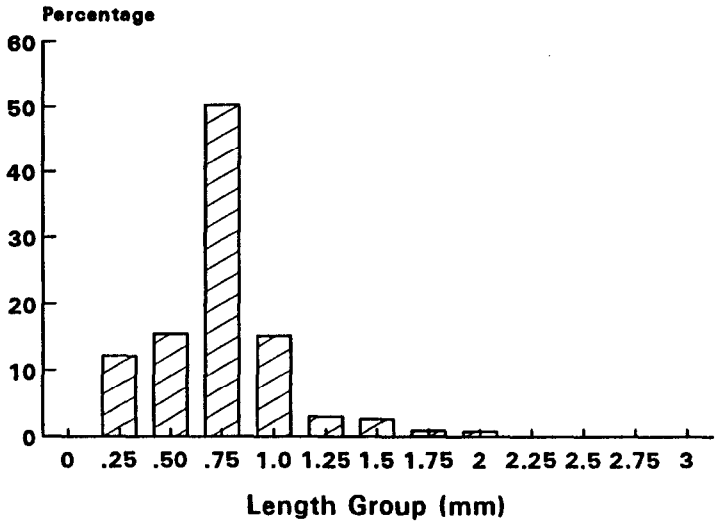
24-Mile Res. 7/16/93



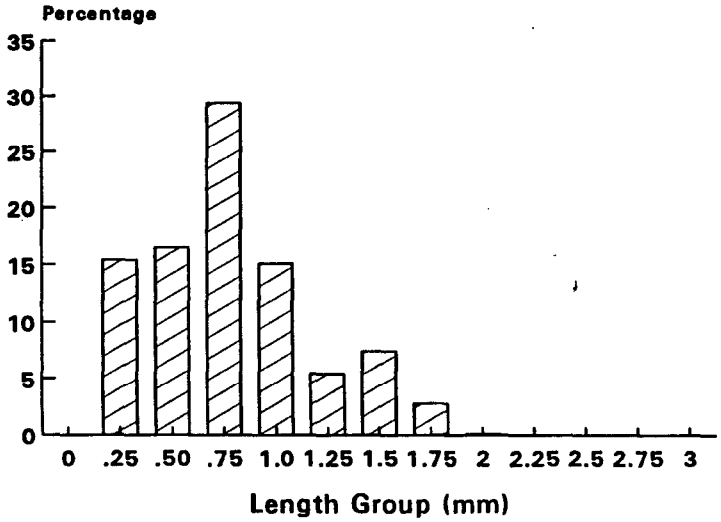
24-Mile Res. 9/22/93



24-Mile Res 7/7/94



24-Mile Res. 9/8/94



Appendix G. (Continued.)

Appendix H. Data summary for zooplankton size structure in Idaho lakes and reservoirs with fingerling-catchable evaluations, 1992-1994.

Location	Date	Taxonomic group	Relative abundance by size (mml									Percent of Daphnia > 1.50 mm
			0.25	0.50	0.75	1.00	1.25	1.50	1.75	2.00	2.25	
Spirit Lake	5/24/92	Bosmina	13	10								
		Copepods	47	293	42	6						0.0
		Daphnia		2	2							
	9/16/92	Bosmina	52	40								
		Copepods	6	28	19	3						0.0
		Daphnia										
	8/10/93	Bosmina	3	4								
		Copepods	201	978	163	28	4					
		Daphnia	9	60	75	77	14					0.0
Hauser Lake	5/24/92	Bosmina										
		Copepods	11	3								
		Daphnia		12	16	8	26	6	6	2		17.7
	9/16/92	Bosmina	2	1								
		Copepods	12	11	3							
		Daphnia		5	11	7	7	4	6	2		28.6
	8/15/93	Bosmina										
		Copepods	3	2	1							
		Daphnia		1	3	10	1					0.0
SpringValley Reservoir	5/24/92	Bosmina										
		Copepods	29	8	12							
		Daphnia			8							0.0
	9/10/92	Bosmina	183	377	79							
		Copepods	39	10	2							
		Daphnia			4	4	3	7				0.0

Appendix H. Continued.

Location	Date	Taxonomic group	Relative abundance by size (mm) 0.25	0.50	0.75	1.00	1.25	1.50	1.75	2.00	2.25	Percent of Daphnia > 1.50 mm
Mann Lake	5/25/92	Bosmina	1	6								
		Copepods	12	74	8	3	1					
		Daphnia		6	16	8	6	1				2.7
	9/9/92	Bosmina	388	7	2							
		Copepods	16	7	2							
		Daphnia	6	28								0.0
	8/18/93	Bosmina	2									
		Copepods	19	95	28	8						
		Daphnia		15	114	8	3	4				2.8
Winchester Lake	5/22/92	Bosmina	7	5								
		Copepods	256	110	5	3						
		Daphnia		3	7	2	4	2				1.1
	9/9/92	Bosmina		2								
		Copepods	4	2								
		Daphnia		100	57	71	24	2				0.8
	6/22/93	Bosmina										
		Copepods	10	42	2							
		Daphnia		21	177	45	28	26	25	5	1	17.4
Soldiers Meadow Reservoir	5/23/92	Bosmina	4		1							
		Copepods	22	77	51							
		Daphnia			3	1	1					0.0
	9/9/92	Bosmina	12	299	45							
		Copepods	22	56	59	15						
		Daphnia		6	48	45	3	2				2.0

Appendix H. Continued.

Location	Pate	Taxonomic grou[p]	Relative abundance by size (mm) 0.25	0.50	0.75	1.00	1.2	1.50	1.75	2.00	2.25	Percent of Daphnia > 1.50 mm
Soldiers Meadow (Cont.)	6/22/93	Bosmina		3								
		Copepods		14	20	9	2					
		Daphnia	2	32	44	21	13	4			3.4	
	8/13/93	Bosmina										
		Copepods	2	19	7	3						
		Daphnia	2	53	122	46	36	5				1.9
Cascade Reservoir	5/20/92	Bosmina	408	19								
		Copepods	6	9	11							
		Daphnia		3								0.0
	6/4/92	Bosmina	43	34								
		Copepods	1	3	12							
		Daphnia		9	4	3	5	3	3	2		27.6
	6/11/92	Bosmina	7	8								
		Copepods	6	9	19	6	1					
		Daphnia		8	12	2	2	1		2	2	22.6
	7/16/92	Bosmina	3	3								
		Copepods	1	7	19	7						
		Daphnia		1		2	3	1				14.3
	7/23/92	Bosmina	305	1								
		Copepods	7	25	17	9						
		Daphnia		10	8	5	8	4	2	2		20.5
	7/30/92	Bosmina										
		Copepods	45	33	30	3						
		Daphnia		8	23	47	28	10	1			9.4

Appendix H. Continued.

Location	Date	Taxonomic group	Relative abundance by size (mm) 0.25	0.50	0.75	1.00	1.25	1.50	1.75	2.00	2.25	Percent of Daphnia > 1.50 mm
Cascade Reservoir (Cont.)	8/13/92	Bosmina	1	3								
		Copepods	36	100	43	13						
		Daphnia		12	5	11	10	6	9	4	1	34.5
	8/20/92	Bosmina			1							
		Copepods	1	11	21	2		1				
		Daphnia		21	7	1	1	3				9.1
C.J. Strike Reservoir	7/6/92	Bosmina	99	14								
		Copepods	1	4	2							
		Daphnia		3	1	3						0.0
Magic Reservoir	5/7/92	Bosmina	76	138	43	12						
		Copepods	47	179	37	15	1					
		Daphnia			21	19	2	1				2.3
	7/3/92	Bosmina										
		Copepods	53	113	17							
		Daphnia		11	32	21	18	8	5	1		14.6
	7/2/93	Bosmina										
		Copepods	47	212	33	4						
		Daphnia		7	23	36	28	23	15	7	3	27.9
	6/23/94	Bosmina	4									
		Copepods	612	519	420	6						
		Daphnia		126	196	147	133	223	93	31	14	37.5
	7/12/94	Bosmina										
		Copepods	3	36	20	4						
		Daphnia		1	14	11	24	11				18.0

Appendix H. Continued.

Location	Date	Taxonomic group	Relative abundance by size (mm) 0.25	0.50	0.75	1.00	1.25	1.50	1.75	2.00	2.25	Percent of Daphnia > 1.50 mm
Magic Reservoir (cont.)	8/18/94	Bosmina										
		Copepods	98	312	133	17						
		Daphnia	4	33	107	159	78	32	6	11		11.4
		Chydorus	1,439									
	10/11/94	Bosmina	11	1								
		Copepods	1,720	1,430	475	1						
		Daphnia	1	15	4	2		1				4.3
Little Wood Reservoir	5/7/92	Bosmina	1	8	1							
		Copepods	29	16	3	4						
		Daphnia		19	398	25	43	9	1			2.0
	7/4/92	Bosmina										
		Copepods	10	99	1							
		Daphnia			2	4	1	2		3		41.7
	7/2/93	Bosmina										
		Copepods	1	4	6	2	2	1				
		Daphnia		3	4	5	7	6				0
	7/28/93	Bosmina										
		Copepods	3	19	36	22	4	1	2			
		Daphnia		68	36	31	98	78	22	5	2	31.5
	6/23/94	Bosmina										
		Copepods	223	447	761	331	131	17	2			
		Daphnia	3	15	22	111	661	540	139	23		46.4
	7/11/94	Bosmina										
		Copepods	183	1965	1796	469	180	64	33	20	1	
		Daphnia		15	72	253.	223	380	197	59	4	53.2

Appendix H. Continued.

Location	Date	Taxonomic group	Relative abundance by size (mm) 0.25	0.50	0.75	1.00	1.25	1.50	1.75	2.00	2.25	Percent of Daphnia > 1.50 mm
Little Wood Reservoir	8/19/94	Bosmina	18	3								
		Copepods	7	159	119	62	11	2	1			
		Daphnia		78	143	69	46	33	35	9		18.6
		Ceriodaphnia	3	2	4	5						
		Diaphanosoma	3	20	27	32	15					
	10/12/94	Bosmina										
		Copepods	241	59	92	93	25					
		Daphnia		93	443	265	182	59	3			5.9
		Diaphanosoma			16	92	90	10				
Springfield Lake Reservoir	6/25/92	Bosmina	12	22	30	1						
		Copepods										
		Daphnia				2	1					0.0
		Eurycerus			3	3	4	3	1	2	1	
	6/22/94	Bosmina	20	4								
		Copepods	1	4	1	1						
		Daphnia	6	30	19	29	35	25	2	1		19.0
		Eurycerus	1	1	4	4		3	2	1		
		Ceriodaphnia	18	25	21	5			1	1		
Daniels Reservoir	5/12/92	Bosmina		1	2							
		Copepods	248	160	173	88	3	1				
		Daphnia		28	325	66	24	38	17	5		11.9
	6/27/92	Bosmina	3	4								
		Copepods	25	83	13							
		Daphnia		6	37	5	5	2	1			5.3
	7/14/93	Bosmina										
		Copepods	242	321	149	120	1	1				
		Daphnia	2	57	138	148.	85	73	7	3	1	16.3

Appendix H. Continued.

Location	Date	Taxonomic grouo	Relative abundance by size (mm) 0.25	0.50	0.75	1.00	1.25	1.50	1.75	2.00	2.25	Percent of Daphnia >1.50 mm
Daniels Reservoir (Cont.)	9/21/93	Bosmina		7	1							
		Copepods	23	64	42	3						
		Daphnia	2	23	18	27	8	9	3	2		15.2
	6/21/94	Bosmina										
		Copepods	371	412	207	103	4					
		Daphnia		16	123	318	260	68	5			9.2
		Chydorus	24									
	7/8/94	Bosmina										
		Copepods	236	816	302	1						
		Daphnia			122	93	91	186	92	16		49.0
		Chydorus	32									
		Ceriodaphnia	36	31	26							
	8/8/94	Bosmina										
		Copepods	131	526	322	41	3					
		Daphnia		16	74	31	34	33	12	7	6	27.2
		Chydorus	4	1								
		Ceriodaphnia	129	399	84							
	9/6/94	Bosmina	1									
		Copepods	1430	754	557		1					
		Daphnia		49	438	176	62	85	63	22	1	19.1
	10/6/94	Bosmina										
		Copepods	1,458	738	700	40						
		Daphnia		21	35	31	37	8				6.1
		Chydorus	34									
		Ceriodaphnia	1,655	1,413	1,162	7						
Twin Lakes	5/12/92	Bosmina										
		Copepods	6	8	3							
		Daphnia		3	8	3	3	2				10.5

Appendix H. Continued.

Location	Date	Taxonomic group	Relative abundance by size (mm) 0.25	0.50	0.75	1.00	1.25	1.50	1.75	2.00.	2.25	Percent of Daphnia > 1.50 mrrt
Twin Lakes (Cont.)	6/30/92	Bosmina	5	1								
		Copepods	159	72	2							
		Daphnia		47	87	10	18	1				0.6
	7/16/93	Bosmina		10								
		Copepods	51	247	133	71	11					
		Daphnia	2	26	66	29	13	7	10	5	13.9	
	6/21/94	Bosmina	1									
		Copepods	1570	1044	468	72						
		Daphnia		33	599	294	165	177	64	12	18.9	
	7/6/94	Bosmina	3									
		Copepods	438	738	219	20						
		Daphnia	2	29	143	129	155	86	21	4		19.5
		Ceriodaphnia	63	50	36							
	8/9/94	Bosmina	37									
		Copepods	881	295	138	6						
		Daphnia		6	145	71	34	31	16	5		16.9
Winder Reservoir	6/29/92	Bosmina	132	84								
		Copepods	50	564	2							
		Daphnia		52	115	65	7					0.0
	7/15/93	Bosmina		2								
		Copepods	62	118	188	8						
		Daphnia	28	166	289	168	141	43	22	6		8.2
Treasureton Reservoir	6/30/92	Bosmina	3									
		Copepods	36	24	8	11						
		Daphnia		4	24	26	13	8	1			11.8

Appendix H. Continued.

Locatio	Date	Taxonomic group	Relative abundance by size (mml 0.25	0.50	0.75	1.00	1.25	1.50	1.75	2.00	2.25	Percent of Daphnia >1.50 mm
Treasureton Res. (Cont.)	7/14/93	Bosmina										
		Copepods	44	150	27	19	15					
		Daphnia	4	10	36	56	24	14	5	5	1	16.1
	9/7/94	Bosmina	3									
		Copepods	3	34	20							
		Daphnia			62	94	83	50	34	39	26	38.4
	10/25/94	Bosmina										
		Copepods	3	358	203	2						
		Daphnia		2	75	177	158	124	85	47	4	38.7
Chesterfield Reservoir	5/13/92	Bosmina	3	3								
		Copepods	12	11	1		1					
		Daphnia		2	20	59	44	3	7	3	2	10.7
	7/16/93	Bosmina										
		Copepods	37	156	107	43	8	1				
		Daphnia	39	141	68	20	29	14	10	9	7	11.9
	9/13/94	Bosmina	10	3								
		Copepods	17	59	124	9	21	1				
		Daphnia		2	216	437	667	499	162	102	31	37.5
		Chydorus	1,961	7								
		Ceriodaphnia	597	1,369	901							
	10/25/94	Bosmina	9	' 4								
		Copepods	105	81	468	59	11	1				
		Daphnia		2	143	226	593	351	124	91		37.2
		Chydorus	466									
		Ceriodaphnia	29	168	243							

Appendix H. Continued.

Location	Date	Taxonomic group	Relative abundance by size (mm) 0.25	0.50	0.75	1.00	1.25	1.50	1.75	2.00	2.25	Percent of Daphnia > 1.50 mn1
24-Mile Reservoir	6/26/92	Bosmina										
		Copepods	9	54	144	71	2					
		Daphnia		17	23	1	2	1				2.3
	6/30/93	Bosmina										
		Copepods	16	51	19	25	10					
		Daphnia		2	21	14	11	5	10	1		25.0
	7/16/93	Bosmina										
		Copepods	2	6	3	4	3					
		Daphnia			1		2					0.0
	9/22/93	Bosmina										
		Copepods	2	2	1		1					
		Daphnia	1		17	5		1	2			11.5
	6/21/94	Bosmina										
		Copepods	255	661	765	263	18	18	5	1		
		Daphnia		35	295	203	52	44	44	17	2	15.5
	7/7/94	Bosmina	2									
		Copepods	85	91	318	79	4	5				
		Daphnia		23	82	31	15	12	12	7	5	13.7
	8/10/94	Bosmina	1									
		Copepods	57	55	78	9	18	3				
		Daphnia	5	23	49	11	7	7	10	6		19.5
	9/8/94	Bosmina										
		Copepods	10	26	38	21	11	8				
		Daphnia		2	55	35	25	25	34	13		38.1

Appendix H. Continued.

Location	Date	Taxonomic group	Relative abundance by size (mm) 0.25	0.50	0.75	1.00	1.25	1.50	1.75	2.00	2.25	Percent of Daphnia ≥ 1.50 mm
24-Mile Reservoir (Cont.)	10/4/94	Bosmina										
		Copepods	6	6	4	3	3	5				
		Daphnia			11	4	7	10	7	6		51.1
Ririe Reservoir	5/5/92	Bosmina	56	48								
		Copepods	30	23	20	3						
		Daphnia		7	7	2	7					0.0
	6/10/93	Bosmina	129	95	2							
		Copepods	14	19	33	18	5					
		Daphnia	5	11	34	35	25					0.9
	7/23/93	Bosmina	2	3								
		Copepods	6	14	6	2	1					
		Daphnia		6	35	15	4	2				3.2
	9/24/93	Bosmina	4	14								
		Copepods	164	352	127	55	19					
		Daphnia	3	77	337	166	58	25				4.6

Appendix I. Temperature and oxygen profiles for nine Idaho waters with fingerling-catchable stocking evaluations, 1994.

Date	Depth (m)	Dissolved oxygen (mg/l)	Temperature (ºC)	Date	Depth (m)	Dissolved oxygen (mg/l)	Temperature (ºC)
Magic Reservoir							
06/23	surface	9.8	15.0	7/12	surface	10.4	16.0
	1	10.0	15.0		1	10.2	16.0
	2	9.6	15.0		2	10.0	15.5
	3	10.0	14.0		3	9.4	15.3
	4	9.5	13.0		4	9.2	15.0
	5	9.4	12.0		5	8.2	12.5
	7	8.8	11.5		6	8.2	13.0
	9	8.9	11.0				
	11	6.4	11.0				
	12	3.5	12.0				
08/18	surface	7.8	18.1	10/11	surface	18.5	6.1
	1	8.0	17.9		1	12.9	6.1
	2	6.5	16.4		2	10.9	6.1
	3	5.9	16.2		3	9.4	6.0
	4	6.0	16.2		4	7.9	6.0
	5	5.9	16.2		5	7.3	6.0
	6	5.2	16.1				
	7	5.5	16.3				
Little Wood Reservoir							
06/23	surface	8.4	13.5	07/11	surface	9.2	15.0
	1	8.2	13.0		1	9.2	15.0
	2	8.4	13.0		2	9.2	15.0
	3	8.4	13.0		3	9.2	15.0
	4	8.4	12.5		4	9.2	15.0
	5	8.5	12.5		5	9.2	15.0
	7	8.2	12.0		7	3.9	14.5
	9	8.2	11.0		9	3.6	13.8
	11	7.7	10.3		11	3.4	13.5
	13	7.4	10.0		13	14.1	15.0
	15	7.2	10.0				
	17	6.9	9.0				
	19	7.0	8.5				
	21	6.5	9.0				
08/19	surface	10.0	15.7	10/12	surface	14.4	6.5
	1	9.6	15.4		1	14.2	6.4
	2	8.7	15.3		2	7.4	6.3
	3	8.3	15.1		3	5.9	5.9
	4	7.8	14.8		4	6.5	5.8
	5	7.3	10.0		5	7.1	5.6
	6	7.3	5.0				

Appendix I. (Continued)

Date	Depth (m)	Dissolved oxygen (mg/l)	Temperature (ºC)	Date	Depth (m)	Dissolved oxygen (mg/l)	Temperature (ºC)
Springfield Reservoir							
06/22	surface	15.4	17.0				
	1	15.2	14.0				
	2	14.8	12.5				
	3	13.0	12.0				
		11.2	13.0				
Daniels Reservoir							
06/21	surface	16.8	14.0	07/08	surface	9.0	17.0
	1	16.0	14.0		1	8.8	15.3
	2	16.2	14.0		2	9.0	14.5
	3	15.4	13.0		3	8.6	14.0
	4	13.2	12.0		4	8.2	14.0
	5	12.4	12.0		5	5.8	12.0
	7	6.2	10.0		7	2.0	10.0
	9	0.9	7.0		9	1.8	7.0
	11	1.0	5.5				
	12	1.0	5.0				
08/08	surface	9.6	17.0	09/06	surface	9.6	13.5
	1	9.6	17.0		1	10.3	13.0
	2	9.3	16.0		2	9.8	13.0
	3	8.2	16.0		3	10.2	13.0
	4	4.8	15.0		4	10.0	13.0
	5	1.4	13.0		5	10.2	13.0
	7	0.4	8.0		7	9.4	13.0
	9	0.6	7.0		8	5.4	12.0
10/06	surface	15.2	7.6				
	1	7.6	7.6				
	2	8.4	7.7				
	3	7.8	7.7				
	4	8.1	7.8				
	5	7.3	7.7				
	6	6.9	7.7				
	7	6.4	7.5				
	8	6.4	7.2				
	9	6.1	6.9				

Appendix I. (Continued).

Date	Depth (m)	Dissolved oxygen (mg/I)	Temperature (ºC)	Date	Depth (m)	Dissolved oxygen (rng/l)	Temperature (ºC)
Twin Lakes							
06/21	surface	15.2	15.3	07/06	surface	7.3	20.2
	1	15.0	15.3		1	7.1	20.0
	2	14.8	15.3		2	7.3	20.0
	3	15.0	:15.0		3	7.2	19.7
	4	1:5.0	15.0		4	7.2	19.5
	5	15.0	14.5		5	7.0	19.2
	7	13.0	12.5		7	1.8	15.0
	9	1.0	10.0		9	0.5	13.0
	11	1.2	7.0		10	0.5	12.0
	13	2.0	7.0				
08/09	surface	6.9	18.0				
	1	6.8	18.0				
	2	6.6	18.0				
	3	7.0	18.0				
	4	6.3	18.0				
	5	3.5	17.0				
Chesterfield Reservoir							
05/26	surface	9.0	18.2	06/23	surface	8.2	19.8
	1	9.0	18.0		1	8.1	20.0
	2	9.0	17.9		2	8.1	20.0
	3	9.0	17.7		3	8.1	20.0
	4	8.4	15.2		4	8.1	20.0
	5	7.9	14.5		5	7.8	19.8
	6	7.6	14.5		6	6.5	19.2
	7	7.2	14.3		7	6.1	19.0
	8	6.9	14.0		8	5.4	18.8
	9	6.3	13.8		9	2.4	18.0
	10	5.3	13.5		9.6	0.8	17.2
	11	4.6	13.5				
07/26	surface	8.7	22.0	08/17	surface	8.1	22.0
	1	8.7	22.0		1	8.0	21.8
	2	8.7	22.0		2	8.0	21.8
	3	8.6	22.0		3	8.0	21.8
	4	8.4	22.0		4	7.9	21.8
	5	8.2	21.8		5	7.6	21.8
	6	5.9	21.2		6	5.0	21.5
	7	3.5	20.7				
	7.6	2.4	20.7				

Appendix I. (Continued)

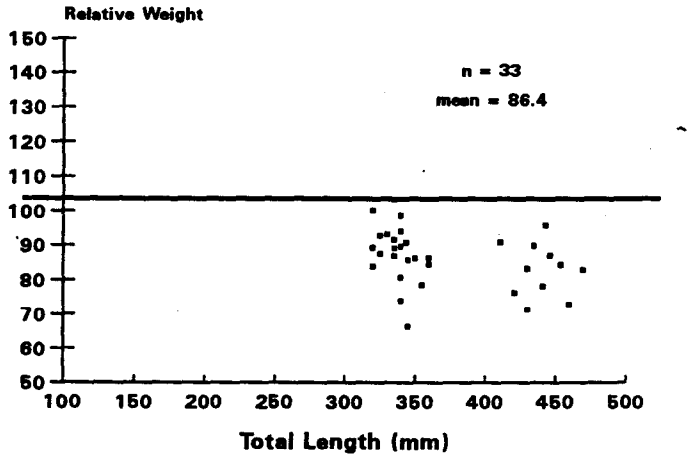
Appendix I. (Continued).

Date	Depth (m)	Dissolved oxygen (mg/l)	Temperature (ºC)	Date	Depth (m)	Dissolved Oxygen (mg/l)	Temperature (ºC)
Chesterfield Reservoir (Cont.)							
09/12	surface	12.6	12.2	10/25	surface	16.2	3.5
	1	10.6	12.2		1	12.4	3.0
	2	8.7	12.0		2	5.2	3.0
	3	7.0	12.0		3	3.6	3.0
	4	6.2	12.0		4	4.5	3.0
	5	5.3	11.9		5	3.6	3.0
	6	4.7	11.7		6	3.0	3.0
	7	2.9	2.8				
24-Mile Reservoir							
06/22	surface	12.0	16.0	07/07	surface	10.4	16.0
	1	12.6	15.3		1	10.1	16.0
	2	12.8	15.0		2	9.5	15.5
	3	13.4	15.0		3	9.0	15.0
	4	13.6	15.0		4	9.0	15.0
	5	13.4	15.0•				
	6	13.0	15.0				
	7	4.8	14.0				
08/10	surface	9.9	17.3	09/08	surface	10.2	13.0
	1	8.6	17.1		1	11.8	12.8
	2	6.2	16.8		2	8.1	12.0
	3	4.3	16.5		3	6.5	11.9
	4	3.4	16.5		4	8.0	11.8
10/04	surface	17.4	6.5				
	1	12.6	6.7				
	2	7.6	6.5				
	3	5.6	6.7				
	4	4.8	6.4				
Treasureton Reservoir							
05/26	surface	8.2	17.2	06/23	surface	8.7	19.2
	1	8.2	17.2		1	8.5	19.6
	2	8.2	17.2		2	8.5	19.6
	3	8.1	16.8		3	8.6	19.6
	4	7.3	15.3		4	8.6	19.6
	5	5.1	14.5		5	8.6	19.6
	6	3.7	14.2		5.6	7.6	19.0
	6.6	3.0	14.0				

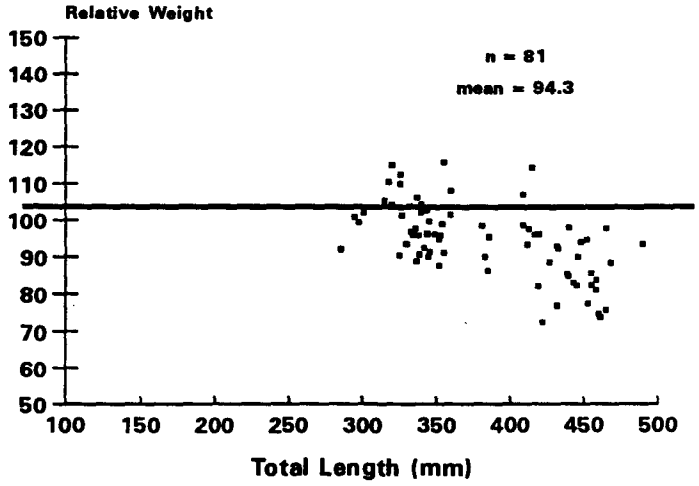
Appendix I. (Continued).

Date	Depth (m)	Dissolved oxygen (mg/l)	Temperature (ºC)	Date	Depth (m)	Dissolved oxygen (mg/l)	Temperature (ºC)
Treasureton Reservoir							
07/28	surface	8.7	20.2	08/17	surface	7.6	20.3
	1	8.7	20.2		1	7.5	20.3
	2	8.6	20.2		2	7.5	20.3
	3	8.7	20.2		3	7.5	20.3
	4	8.4	20.2		4	7.2	20.3
	4.3	7.8	20.2		4.3	5.8	20.0
			20.2				
09/07	surface	15.2	13.2	10/25	surface	14.8	3.5
	1	14.2	13.0		1	11.6	3.0
	2	9.4	12.1		2	6.6	3.0
	3	8.0	12.0		3	4.6	3.0
	4	8.5	12.0		4	4.3	3.0
Winder Reservoir							
05/26	surface	7.9	18.0	06/23	surface	9.1	20.5
	1	8.2	18.0		1	9.1	230.5
	2	9.2	17.0		2	9.1	20.5
	3	9.4	16.0		3	9.1	20.5
	4	9.2	16.0		4	9.1	20.5
	5	8.1	15.3		5	8.2	19.5
	6	6.8	14.8		6	6.9	19.0
	7	3.2	13.2		7	6.3	18.5
	8	1.7	11.1		8	1.8	18.2
	9	0.8	10.2				
07/28	surface	7.2	22.5	08/17	surface	6.8	21.0
	1	7.2	22.5		1	6.8	21.0
	2	7.1	22.5		2	6.4	21.0
	3	6.9	22.5		3	4.5	21.0
	4	6.4	22.5		4	1.5	20.5
	5	3.3	22.5		5		
	6	0.7	22.0				

October, 1992

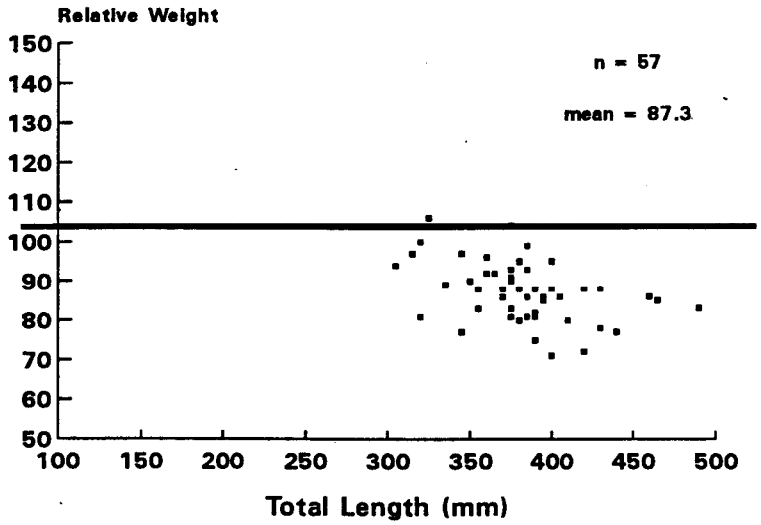


October, 1994

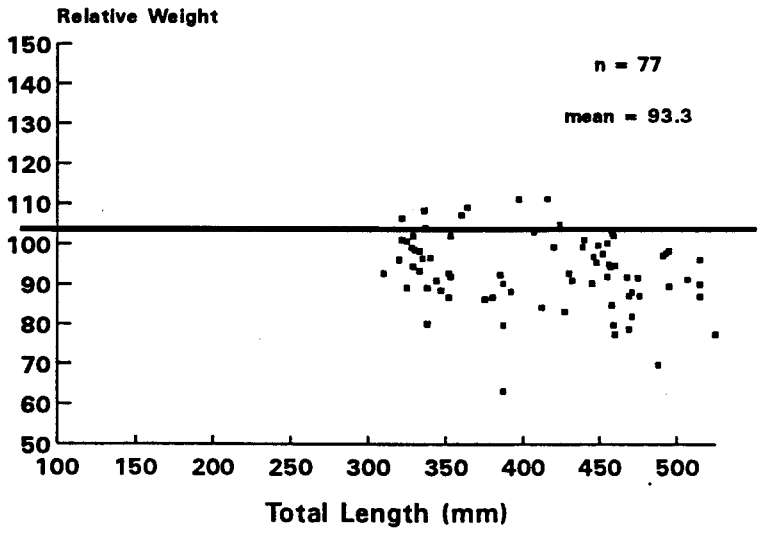


Appendix J-1. Relative weights for trout in Daniels Reservoir in October 1992 and October 1994.

September, 1993



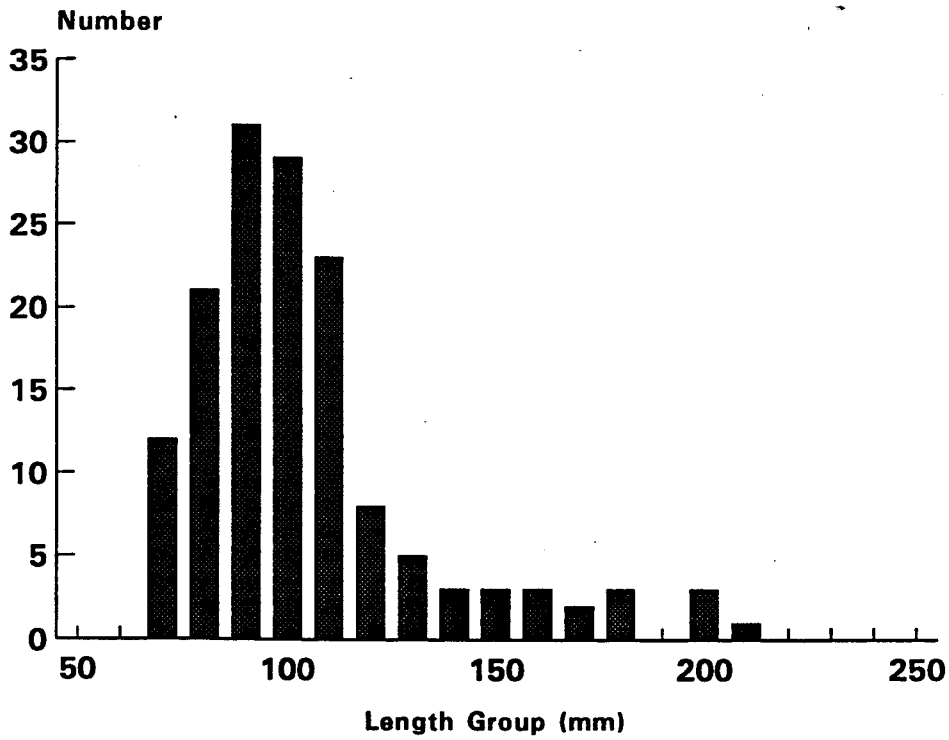
September, 1994



Appendix J-2. Relative weights for rainbow trout in 24-Mile Reservoir, September 1993 and September 1994.

Appendix K. Mark-recapture data for population estimates on Daniels Reservoir, May 1994. The spring 1994 catchables were planted after marking runs for the other six groups.

Fish group	Total marked	Total recaptures	Marked recaptures	Recapture rate (%)
Spring 1992 catchables	24	2	0	0.0
Fall 1992 fingerlings	109	38	5	4.6
Spring 1993 catchables	45	25	1	. 2.2
Fall 1993 fingerlings	123	207	14	10.6
Cutthroat x rainbow hybrids	43	11	0	0.0
Cutthroat	43	19	0	0.0
Spring 1994 catchables	4690 (planted)		479	10.2



Backpack Electrofishing

Appendix L. Length-frequency of juvenile trout sampled in Malad spring above Daniels Reservoir, September 1994.

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IDAHO DEPARTMENT OF FISH AND GAME

Steven M. Huffaker, Chief
Bureau of Fisheries

Funds Expended:

State:	$32,381
Federal:	$97,143
Total:	$129,524

Al Van Vooren
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